Journal of
ORAL SURGERY

CARL W. WALDRON, M.D., D.D.S., EDITOR
950 MEDICAL ARTS BUILDING, MINNEAPOLIS 2

VOL. 5 OCTOBER 1947 NO. 4

DISEASES OF THE MAXILLARY SINUSES RESULTING FROM PATHOLOGIC CHANGES

Kurt H. Thoma, D.M.D.,
Boston

Those diseases of the maxillary sinus which originate from pathologic conditions of the teeth or from diseases of the maxillary bones will be discussed in this paper. We may distinguish: hematoma, infections, cysts, benign tumors, locally infiltrating tumors and malignant tumors.

Hematoma

In fractures of the middle of the face hemorrhage is frequently caused by rupture of the infra-orbital and superior alveolar arteries which are located in canals contained in the walls of the maxillary sinus. The x-ray examination reveals that the affected sinus is radiopaque (Fig. 1). Spontaneous evacuation of a simple hematoma generally occurs through the ostium. For a bleeding hematoma, however, surgical intervention to arrest the hemorrhage may be indicated. A bleeding hematoma is recognized by the pulsating pressure in the affected side of the upper jaw and frequent small hemorrhages into the nose.

Infection of the extravasation may bring about serious complications which are generally initiated by chills, fever and severe pain. The nasal discharge becomes purulent in character, and considerable swelling may be evident over the affected antrum.

Read at the twenty-ninth annual meeting of the American Society of Oral Surgeons, Boston, July 31-August 2, 1947.

Professor of oral surgery, Harvard University, and oral surgeon and chief of dental clinic, Massachusetts General Hospital, Boston.

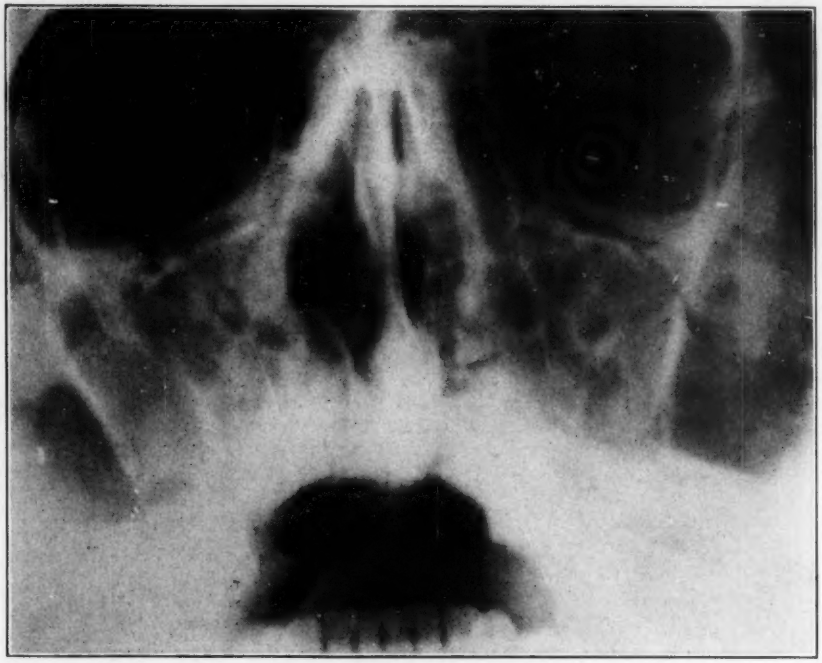

Fig. 1.—Fracture of maxilla. Each maxillary sinus is filled with a hematoma

Infections

Infections of the maxillary sinuses are frequently of odontogenic origin. Chronic maxillary sinusitis is probably the most common disturbance, and from it acute inflammation and suppuration may develop. The latter may result from exacerbation of a chronic infection brought about through lowered resistance. This lowering of resistance often occurs after influenza and pneumonia or it may be caused by fatigue and debilitating diseases.

Acute infections frequently result when the maxillary sinus is opened during removal of a tooth affected by an acute alveolar abscess, or in cases in which an infected root is displaced into the antrum. Involvement resulting from acute osteomyelitis of the maxilla is a rare disease. Acute dento-alveolar abscesses generally find an outlet to the oral surface of the bone and only rarely empty spontaneously into the antrum.

The etiologic factor in odontogenic infection of the maxillary sinus varies. Perhaps the most common cause is periapical infection. It occurs especially in cases in which the root apex protrudes into the antrum and is covered only by thin bone. This condition favors spread of the infection, particularly if secondary suppurative processes occur in the dental granuloma. However, Bauer[1] and Thoma[2] showed, by means of microscopic sections, that inflammatory changes occur in the membrane of the sinus, even if considerable bone separates the infected apex of the tooth from the floor of

1. Bauer, W. H., Maxillary Sinusitis of Dental Origin. *Am. J. Orthodontics (Oral Surg.)* 29:133 (March) 1943.
2. Thoma, K. H., *Oral Pathology*. St. Louis: C. V. Mosby & Co. Second Edition, p. 738.

Fig. 2.—Roentgenogram from Water's position, showing cyst in maxillary sinus

the antrum. Furthermore, it also has been established that infection from periodontal pockets may contribute to the disease. Another frequent cause of infection of the antrum is excessive trauma resulting from extraction of teeth or from other surgical procedures. If the membrane of the sinus is perforated bacteria may easily be introduced, especially if a septic condition exists in the floor of the antrum. If an oro-antral fistula remains after the operation, infection may subsequently enter from the mouth.

The pathologic changes that occur during the presence of the various types of odontogenic infections of the maxillary sinus should be kept in mind. In acute infection, because of marked edema and inflammatory infiltration, the membrane of the antrum is greatly enlarged and often obliterates the entire cavity. The catarrhal form of inflammation must be differentiated from acute infection. The former usually is associated with colds, and the secretion is mucoid in character. In the suppurative form, purulent and often seropurulent discharge occurs. As a rule the pus is abundant and may or may not drain adequately through the ostium. If drainage is inadequate the symptoms are likely to be more severe. These symptoms are swelling of the affected side of the face and pressure in the antrum, which may make the teeth sensitive to percussion and cause a dull toothache. Severe pain may be present, either a lateral headache or a neuralgic condition which prevents sleep unless counteracted by narcotics. The pus may be evacuated through the nostril or may drop into the naso-

Fig. 3.—Large globulomaxillary cyst injected with Iodochloral is seen encroaching on the maxillary sinus

pharynx. The discharge has a characteristic odor in cases of odontogenic infection. The diagnosis generally can be made easily from the clinical signs and symptoms. Transillumination and x-ray studies may be of value, particularly in determination of the cause of the disease and the possible involvement of the accessory sinuses. A white blood cell count may be of use in differentiation between infection and other pathologic involvement of the antrum.

In chronic infection the onset of the disease is usually very insidious in character. The first changes occur in the part of the antral mucosa which is nearest the infected tooth. Small localized abscesses and cysts may cause a thickening and later polypoid degeneration. Polyps may ultimately fill the entire cavity. Symptoms are not significant as a rule, and a clinical diagnosis is not as easily made as in the case of suppurative infection. General malaise, indefinite neuralgic pains and periodic discharge of pus into the nose are commonly experienced. The latter occurs in the morning and when the person bends the head down or to the unaffected side, which facilitates evacuation of pus through the ostium. A help in diagnosis is a test irrigation made by means of a trochar pressed through the naso-antral wall. Transillumination is often sufficient to determine the character of the disease. The roentgen examination is of great value. Films exposed from Water's position give the best view of the antrums and aid in differential diagnoses to distinguish between infection and cysts and tumors and to discover extension of the disease to accessory sinuses.

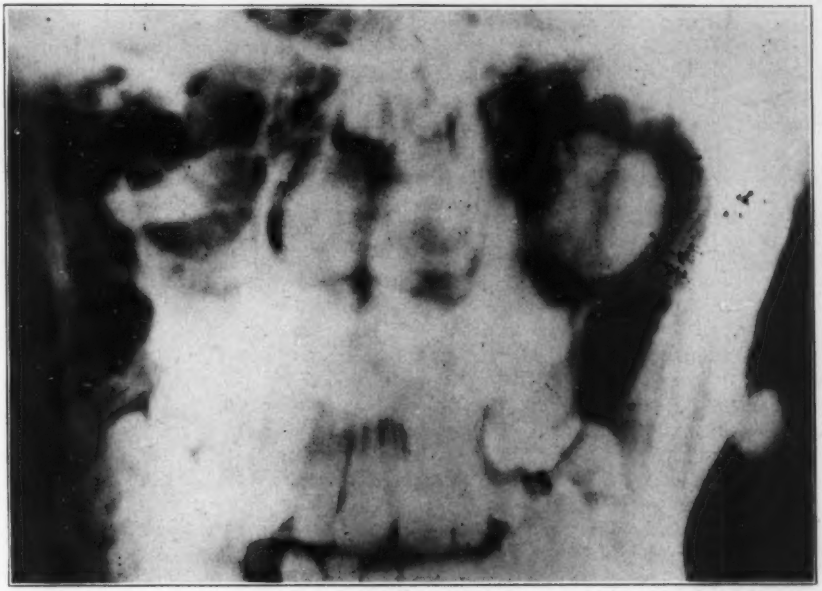

Fig. 4.—Osteoma in maxillary sinus

Cysts

Numerous cysts may form in the antral mucosa at any location. They are often spoken of as mucoceles of the maxillary sinus. From these must be differentiated cysts of odontogenic origin.

Radicular cysts forming from epithelized dental granulomas in the floor of the maxillary sinus probably are more common than dentigerous cysts. The latter arise particularly from the dental follicles of unerupted third molars or displaced cuspids but they also may develop from unerupted supernumerary teeth. In addition to these cysts of dental origin globulomaxillary cysts may encroach on the antrum. These cysts, formed from cell rests in the embryonic fissure between the lateral incisor and cuspid, cause the roots to diverge and may extend far into the substance of the maxilla and into the maxillary sinus if they enlarge sufficiently.

Early signs and symptoms of cysts extending into the maxillary sinus are not remarkable. When the entire cavity is obliterated, however, expansion causes a bulging of the outer wall and thinning of the bone. This cortical thinning and the liquid contents of the cyst account for the parchment-like crepitus on palpation.

Diagnosis of these cysts is made by clinical examination, often supplemented by puncture with a needle and aspiration. The contents of the cyst is generally mucoid in character, although radicular cysts may contain mucopurulent fluid and abundant cholesterol crystals. Aspiration especially aids in differentiation between cysts and solid tumors.

The roentgen examination is more reliable than the clinical study. It is helpful in determining both the size of the cyst and the extent of the involvement of the antrum (Fig. 2). It also helps in differential diagnosis. Exposures should be made

from Water's position, with a lateral view, and dental and occlusal pictures should be taken as indicated by the location and type of lesion. Generally there is no difficulty in reading the roentgenogram. First, the cyst divides the maxillary sinus by a thin partition of circular outline and in far advanced cases it may expand its walls. When the cyst is small, or if the outline is not easily discernible, injection of a radiopaque substance such as Lipiodol (E. Fougera) or Iodochloral (G. D. Searle) through the aspirating needle will be found of great diagnostic aid (Fig. 3).

Benign Tumors

Tumors forming in the alveolar process of the maxilla may extend into the maxillary sinus. Such tumors are generally of osteogenic or odontogenic origin.

Osteomas in the antrum are usually attached to the wall by a pedicle, and if roentgen exposures are made from an anteroposterior and lateral view the attachment can be demonstrated (Fig. 4). The tumor appears as a well defined radiopaque object that is easily recognized.

The fibro-osteoma, also known as ossifying fibroma and localized osteitis fibrosa, develops in the second and third decades of life and is a fairly common tumor. It occurs in unilateral and bilateral forms, forming in the spongiosa of the bone and gradually changing its entire architecture. It causes expansion of the maxilla with bulging of the palate and alveolar process. This is followed by asymmetry of the face as the tumor involves the malar bone and the maxillary sinus, the latter generally becoming completely obliterated.

Symptoms are not remarkable. Pain rarely plays an important part in this disease. The roentgen examination shows a characteristic change in the architecture of the bone. Landmarks are obliterated, the expansion of the bone is visualized, and in general the diagnosis is easily established (Fig. 5).

Other benign tumors such as angioma, fibroma and myxoma rarely invade the antrum, nor does the central giant-cell tumor which is generally limited to the spongiosa of the maxillary bone.

Odontomas, which occur as frequently in the maxilla as in the mandible, may encroach on the maxillary sinus, particularly in the case of cystic odontomas. The odontoma, however, whether of a compound or complex nature, is usually encapsulated by connective tissue. It can be shelled out without opening the sinus cavity or at least without rupturing the schneiderian membrane of the antrum.

The diagnosis is based on the absence of teeth, enlargement of the alveolus, and especially on x-ray examination which clearly shows the size and number of the calcified bodies.

Locally Infiltrating Tumors

Certain tumors, which are not generally classified as malignant, grow by infiltration of adjacent structures. Two are of especial interest, the adamantoblastoma and the mixed tumor of the type that affects the salivary gland.

Incidence of the adamantoblastoma is much less frequent in the maxilla than in the mandible. If this tumor develops in the maxilla the maxillary sinus soon becomes involved, and there develops a marked expansion of both the facial and nasal walls and the palate.

The roentgen film generally discloses the polycystic character of the tumor and shows the expansion of the walls of the antrum. Biopsy is the most reliable means of making a diagnosis.

The mixed tumor of salivary gland type originates frequently on the lateral half

Fig. 5.—Fibro-osteoma of maxilla

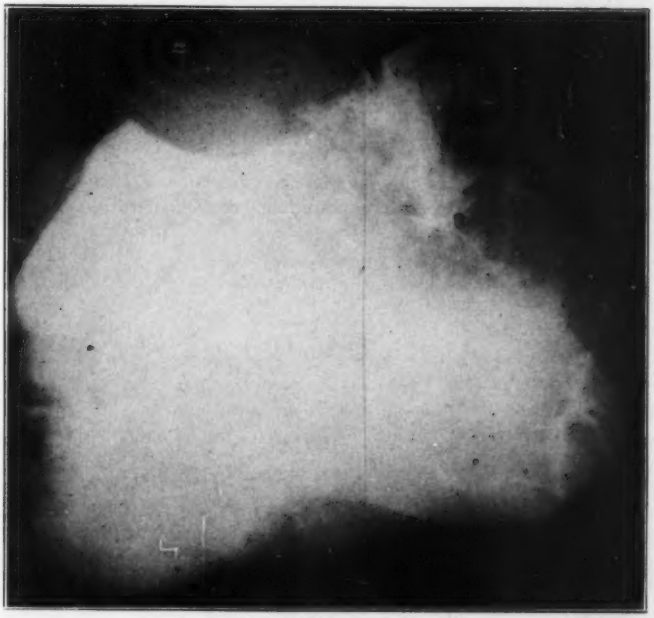

Fig. 6.—Mixed tumor of salivary gland type involving entire maxilla. (Roentgenogram of biopsy specimen)

Fig. 7.—Osteogenic sarcoma showing "sunray" effect

of the hard palate where it forms a very slowly growing, firm and painless mass. However, these tumors may undergo malignant changes even after many years of slow development, resulting in rapid growth and invasion. The antrum in such cases is soon filled with the tumor mass, causing marked expansion, pain, exophthalmos and diplopia.

The roentgen examination shows the invasion of the sinus, revealing a dense shadow with coarse septae extending a short distance from the periphery into the tumor (Fig. 6). To make certain that the diagnosis is correct it is generally necessary to perform biopsy.

Malignant Tumors

Malignant tumors may develop in the maxillary sinus and, after showing no clinical signs for a long period, may perforate the palate or alveolar mucosa in an edentu-

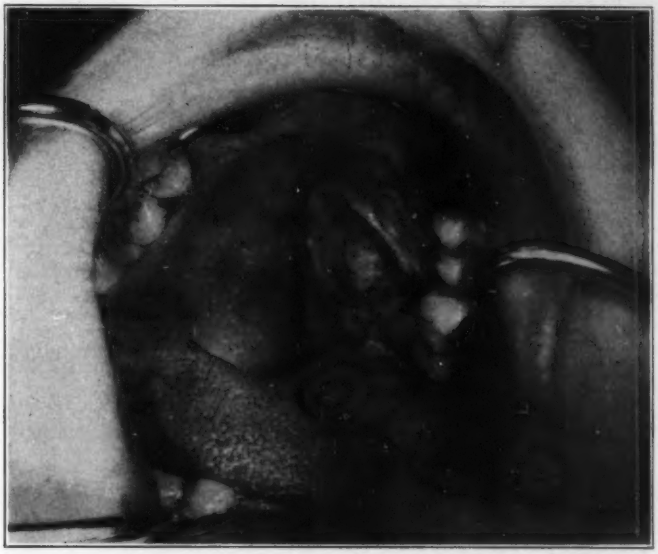

Fig. 8.—Epidermoid carcinoma involving palatal mucosa

lous area, or may proliferate through the socket of a tooth previously extracted to relieve soreness and pain caused by the disease. Other tumors develop from the alveolar mucosa and involve the antrum secondarily. In far advanced cases the origin is not easy to establish. Biopsy should never be neglected.

Fibrosarcoma and osteogenic sarcoma are rare diseases. These tumors are not easily diagnosed, particularly in the early stage of their development. To relieve the associated pain which generally is referred to the teeth, extractions are frequently resorted to but without relief of symptoms. If a swelling develops later and more teeth become loose more of them are sacrificed, and thus the best time for curative treatment of the disease is wasted in symptomatic treatment.

Characteristic symptoms finally appear when the disease has reached an inoperable stage. These symptoms are (1) changes in the contour of the face; (2) increased warmth of the affected part and appearance of dilated veins under the thinned-out skin; (3) swelling of the alveolus and palate, and (4) loosening and spacing of the teeth. If the maxillary sinus is involved discharge from the nose is not uncommon and may be seropurulent in character. As the tumor expands, the malar bone and the orbit may become involved. The rapidity of growth varies in individual cases according to the grade of the malignancy.

The roentgen examination is probably the most important aid in diagnosis. The findings, however, vary greatly in accordance with the type of tissue produced. The osteolytic type, containing a great deal of fibrous tissue, is generally more malignant than the osteoblastic type in which mature bone is deposited. The peripheral bone formation spoken of as "sunray" effect is present in about 15 per cent of tumors of this type (Fig. 7). If the antrum is involved, the naso-antral wall and the orbit may become expanded and destroyed.

Epidermoid carcinoma of the antrum originating in the maxilla is very much more

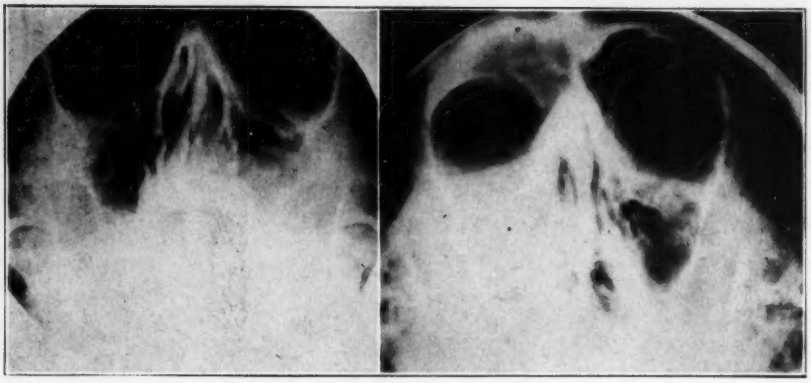

Fig. 9.—Left: Epidermoid carcinoma involving maxillary sinus. Right: Epidermoid carcinoma with far advanced destruction of antral walls

common than the sarcoma just described. The poorly differentiated, infiltrating type of epidermoid carcinoma may involve the maxillary sinus early, without developing a large surface lesion (Fig. 8). On the other hand, the well differentiated, slowly growing form produces a bulky local growth without involving the antrum. Teeth may become loose, and, if they are extracted, the wounds fail to heal. Exuberant cancer tissue may grow from the socket, through which a probe or a curet may be inserted into the antrum to remove some tissue for pathologic diagnosis. Pain and nasal discharge, often of a purulent character, and frequent hemorrhages from the nose may be complained of by the patient. The walls of the antrum may be destroyed, and the disease may invade the accessory sinuses, the zygoma, the orbit, the nasopharynx, the infratemporal region and the base of the skull. Lymph nodes, when involved, generally belong to the deep cervical chain. Metastases to the lungs and other vital organs occur early, however, and death frequently ensues before the local extensions enumerated may complicate the picture.

Roentgen examination of the sinuses is indicated in all cases of carcinoma of the palate or maxilla. The involvement of the antrum is easily demonstrated (Fig. 9 left), and destruction of the bony wall suggests far advanced disease (Fig. 9, right). A careful study should be made to determine whether there are other complications. In all cases of malignant tumors of the maxillary sinuses a roentgenogram of the chest should be taken, since the presence of metastases to the lungs contraindicates any operative procedure for elimination of the primary lesion.

Adenocarcinoma, which is far less common than the epidermoid form, resembles in some respects the adamantoblastoma. Just as the latter tends to develop a highly specialized epithelium of ameloblastic type, so does the adenocarcinoma tend to develop highly specialized epithelium of a glandular nature. This tumor, like the adamantoblastoma, is locally invasive, perhaps more so than the latter, since it is less likely to remain encapsulated and spreads more easily. It forms a bulky mass which is likely to cause great deformity, and early in its course it involves the accessory sinuses and fossae adjacent to the antrum (Fig. 10).

In contrast to the growth of epidermoid carcinoma, metastases to the lymph nodes and vital organs occur late, and even if the growth recurs after its excision, the disease tends to remain localized. Recurrence is not uncommon, because of the infiltrat-

Fig. 10.—Enlargement of upper jaw by adenocarcinoma

ing character of adenocarcinoma, and therefore a careful clinical and x-ray study is indicated to determine how far the disease has progressed. Ultimately, if the disease is not cured, metastases will form similar to those which develop in epidermoid carcinoma of the upper jaw.

Summary

The maxillary sinus can become involved by a large variety of pathologic entities derived from the teeth or jaws. Clinical differentiation is not always easy, and therefore a careful physical examination should be supplemented by a thorough x-ray study and, in case of tumors, a pathologic examination by means of biopsy.—*1180 Beacon Street, Brookline, Boston.*

ANATOMIC STUDY OF THE MAXILLARY SINUS FROM THE STANDPOINT OF THE ORAL SURGEON

Max H. Jacobs, M.D., D.M.D.,
Boston

Oral surgeons are called on to treat patients with fractures of the maxilla which include one or more walls of the sinus; patients with sinusitis caused by dental infections, and those with benign and malignant tumors of the jaw and palate involving the sinus.

A study of the maxillary sinus from the standpoint of the oral surgeon necessitates a knowledge of the structures directly within the walls of and surrounding the sinus, and the relation of the teeth to the floor of the sinus from infancy to childhood.

It is not as important to know that the maxillary sinus is a pyramidal space within the body of the maxilla, having a base, an apex, a roof, and anterior, lateral and posterior surfaces, as it is to know the contents of two fossae in relation to the posterior wall, the course and character of the nerves and vessels within the walls of the sinus, the relation of the roof to the eye and the variations that exist in the relation of the roots of the teeth to the floor of the sinus.

General Considerations

All writers agree that there is no constant or so-called normal type in the anatomy of the maxillary sinus. It is obvious that with variations come altered size, shape and anatomic changes.[1] Not only do the size and shape vary in different skulls but they may vary in the same person. In some skulls the sinus may extend from the maxillary central incisor to the posterior wall of the maxilla. In others, the anterior wall of the sinus may be found as far distally as the second bicuspid.

The thickness of the sinus walls is not constant, especially the roof and floor. Thickness of the roof may vary from 2 to 5 mm. and that of the floor from 2 to 3 mm. in edentulous areas (Fig. 1), to 5 to 10 mm. above the apices of the teeth in mouths with teeth (Fig. 2, left). The thickness of the walls is not influenced by the size of the sinus.

Occasionally the sinus dips down into the alveolus between the teeth, increasing its vertical dimension (Fig. 2, center). Sometimes part of the sinus may be partitioned off so that it may be mistaken for a cyst (Fig. 2, right). Examination made through an opening made through the buccal mucosa and bony wall of this region disclosed the to and fro movement of the membranous lining of the maxillary sinus during respiration. Penetration of an aspirating needle through the lining yielded no fluid.

The size of the sinus may be influenced by the presence or absence of teeth, by growth and development of the alveolus and by heredity. Gray,[2] citing Turner, stated that the measurements of a sinus of average size are: vertical height opposite the first molar 3.75 cm; transverse breadth 2.5 cm., and anteroposterior depth 3 cm.

Read at the twenty-ninth annual meeting of the American Society of Oral Surgeons, Boston, July 31-August 2, 1947.

1. Schaeffer, J. P., The Sinus Maxillaris and Its Relations in the Embryo, Child, and Adult Man. *Am. J. Anat.* 10:313, No. 2, 1910.
2. *Gray's Anatomy.* Philadelphia: Lea and Febiger, 1936. Twenty-third edition, p. 988.

Fig. 1.—Large maxillary sinus with extremely thin bony floor

Fig. 2.—Left: Thickness of alveolar floor above apices of teeth. Center: Dipping down of sinus into alveolus between teeth. Right: Partitioned sinus simulating retained maxillary cyst

Development of Maxillary Sinus

Because of the frequent occurrence of injuries to the jaws and sinuses in infants and children as a result of automobile accidents and falls from cribs and chairs, it is necessary for the oral surgeon to be familiar with the growth and development of the sinuses.

The maxillary sinus starts in the third month of fetal life as an evagination or outpouching of the nasal mucous membrane (Fig. 3). It is the downward extension of a portion of the infundibulum. At the infant's birth it has the appearance of a slit-like recess.[3]

There are a number of theories which attempt to explain the processes in the de-

3. Maresh, M. M., Paranasal Sinuses From Birth to Late Adolescence. 1. Size of the Paranasal Sinuses as Observed in Routine Postero-Anterior Roentgenograms. *Am. J. Dis. Child.* 60:55 (July) 1940.

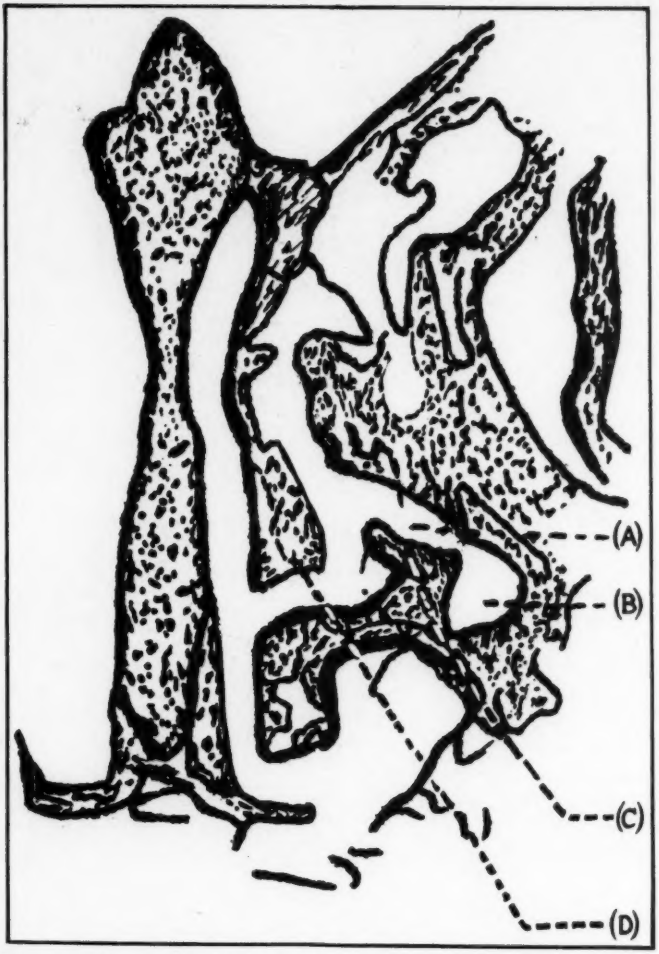

Fig. 3.—Diagrammatic sketch in sagittal plane, depicting outpouching of nasal mucous membrane to form maxillary sinus. (A) infundibulum, (B) maxillary sinus, (C) uncinate process and (D) middle turbinate

velopment of the sinus. One of the more important theories is that of growth by pneumatization on a physical basis. Since the principle growth of the sinuses occurs after breathing begins, bone resorption takes place owing to variation in air pressure, particularly that of expiration.

Soon after birth of the infant the sinus cavity is about the size of a deciduous molar bud. As the maxilla increases in size the sinus grows 2 mm. vertically and laterally and 3 mm. anteroposteriorly each year for about eight years (Fig. 4). Expansion is less rapid vertically and laterally because of the close relation of the developing teeth to the orbit.

Fig. 4.—Sagittal plane, showing growth of sinus at (A) twelve months, (B) sixteen months and (C) nine years. (Courtesy of Pancoast, Pendergrass, and Schaeffer, *Head and Neck in Roentgen Diagnosis.* Springfield, Ill.: Charles C. Thomas)

The lateral growth of the maxillary sinus can be noted by the changing relation of the sinus to the infra-orbital canal. Prenatally, the canal is lateral and inferior to the primitive antrum, gradually assuming a position medial and superior to it.

At first the nasal or medial wall is in closer relation to the middle meatus than to the inferior meatus. The antrum develops downward and backward during the dentition of the permanent teeth. Development ceases at the age of fifteen, except in the posterior-inferior angle which descends after eruption of the third molar.

At the time of the infant's birth the floor of the maxillary sinus is 4 mm. above the floor of the nose. At the age of eight or nine it is on about the same level and begins to penetrate the body of the zygoma. In the adult, it is 4 to 5 mm. below the floor of the nose.

Terminology

The antrum is known as the maxillary sinus, maxillary antrum and antrum of Highmore. The anterior surface is sometimes called the facial surface; the posterior surface, the infratemporal; the external surface, the lateral; the internal surface, the medial surface or base, or the nasal or antronasal wall; the superior surface, the orbital surface or roof, and the inferior surface, the floor or alveolar surface.

Anterior or Facial Surface

The anterior surface of the sinus must be differentiated from the anterior wall of the maxilla. The anterior wall is rarely common to both. When it is one and the same it is indicative of an extremely large sinus extending to the lateral incisor region.

The external surface of the anterior wall of the maxilla is marked by two fossae, the incisive and the canine. These are separated by a vertical ridge, the canine eminence, which corresponds to the socket of the cuspid tooth. It is this eminence which usually marks the most anterior portion of the anterior surface of the sinus.

Above the canine fossa is the infra-orbital foramen, which is the end of the infra-orbital canal, for transmission of the infra-orbital vessels and nerve. The terminal branches of this nerve supply the side of nose, lower eyelid and upper lip. It does not

Fig. 5.—Anterior surface of maxillary sinus, showing position of (A) ganglion of Bochdalek, (B) anterior superior alveolar nerve and (C) infra-orbital nerve

supply the anterior wall or mucous membrane of the sinus.

Just before the infra-orbital canal ends, a small canal is given off on the orbital surface of the sinus and runs downward in the substance of the anterior antral surface for transmission of the anterior superior vessels and nerves to the anterior teeth of the maxilla (Fig. 5).

The most common surgical approach to the maxillary sinus is through the canine fossa. The fossa gives rise to the canine muscle. This muscle is overlapped by part of the quadratus labii superioris. Both muscles are supplied by filaments of the facial nerve. A horizontal incision made through these muscles may result in a temporary droop of the upper lip. Therefore, there is a tendency for some operators to resort to a vertical incision at the approach to the sinus.

An opening made through the anterior wall of the maxillary sinus may result in the removal of bone which contains the anterior superior alveolar canal with its contents. Afterward there may be lack of response to vitality tests of the maxillary anterior teeth. These teeth give a positive response after several weeks or months.

In the past, anatomists described a thickening or knob of nerve fibers in the region where the anterior superior alveolar and middle superior alveolar nerves meet to form a plexus. This knob has been termed the ganglion of Bochdalek (Fig. 5). Microscopic examination of this thickened group of nerve fibers reveals no neuroglia cells or sympathetic nerve fibers. Therefore it is not a true ganglion. The question

Fig. 6.—Lateral surface of maxillary sinus, showing position of (A) ganglion of Valentin, (B) middle superior alveolar nerve and (C) posterior superior alveolar nerve

arises, is this nerve area the point from which regeneration of nerve fibers to the anterior teeth occurs?[4]

The internal surface of the anterior wall of the sinus is marked by a smooth ridge at the superior portion, representing the anterior superior alveolar canal. The canal terminates above the alveolus, and some nerve filaments are distributed to the anterior teeth, while other filaments extend distally to form a plexus with the middle superior alveolar nerves.

Lateral or External Surface

The lateral wall of the sinus corresponds to the posterior portion of the anterior or facial wall of the maxilla.

This surface contains the middle superior alveolar canal, comprising the middle superior alveolar vessels and nerves which supply the maxillary bicuspids and sometimes the mesiobuccal root of the first molar. This canal is given off from the back part of the infra-orbital canal and runs downward and anteriorly in the substance of the bone. Above the alveolus some nerve filaments are distributed to the bicuspids and mesiobuccal root of the first molar. Other filaments unite with fibers of the anterior superior alveolar nerve to form the plexus in which the ganglion of Bochdalek is situated. Other fibers pass distally to unite and form a plexus with fibers

4. *Gray's Anatomy*. Philadelphia: Lea and Febiger, 1913. Spitzka edition, p. 984.

from the posterior superior alveolar nerve. This creates a thickened knob of nerve fibers termed the ganglion of Valentin (Fig. 6).

Since every structure in the body has a function, even though at times it is unknown, one must consider the possibility of this ganglion being the source for regeneration of nerve tissue to the bicuspids if the contents of the canal are destroyed during the surgical approach to the antrum above the first molar and bicuspid region.

Orbital Surface or Roof

The orbital surface of the maxillary sinus forms the greater part of the floor of the orbit. It is traversed in the middle by the infra-orbital canal. This commences in a groove starting on the superior border of the posterior or infratemporal surface of the sinus. The middle superior alveolar canal is given off from the infra-orbital canal in its posterior aspect and traverses the substance of the bone of the lateral surface of the sinus. Before the infra-orbital canal ends in the infra-orbital foramen it gives off the anterior superior alveolar canal.

The thickness of the roof varies greatly. It is thickest as it approaches the infra-orbital ridge and thinnest in the center where it may measure 1 or 2 mm. It is obvious that promiscuous curettage of the orbital surface may cause penetration of the orbit with damage to the globe of the eye.

Alveolar Surface or Floor

The floor of the maxillary sinus is formed by the alveolar process of the maxilla. If the distance between the apices of the posterior teeth and floor is great, the floor is smooth except where anatomic ridges and septa are present.

If there is little or no distance between the apices of the teeth, and the floor is thin, there are conical bony projections into the sinus. At times there may be only the mucous membrane of the sinus covering the roots.

Posterior or Infratemporal Surface

The most important antral surface from the standpoint of the oral surgeon is the infratemporal surface. In its thinnest portion the wall measures 1 mm.

This surface forms the anterior boundary of the pterygopalatine and infratemporal fossae. The contents of these fossae are important and may be injured during operation on or around the posterior surface of the sinus if the anatomy of this region is not known.

This possibility was clearly illustrated in a case in which a dentist, attempting to remove an impacted maxillary third molar, pushed the tooth into the sinus and then inadvertantly forced it through the posterior wall into the infratemporal fossa. Attempting to recover the tooth with elevators, he continued to push it up until it almost reached the inferior orbital fissure. During the operation a severe hemorrhage developed, probably caused by injury to one of the larger vessels in the infratemporal fossa. The dentist became alarmed and made an emergency call for aid. The hemorrhage was arrested with difficulty. Several spicules of bone from the posterior alveolus and posterior wall of the sinus were removed, after which the molar was picked out (Fig. 7). Undue force might have pushed the tooth through the pterygomaxillary fissure into the pterygopalatine fossa.

The infratemporal surface is convex, thin in its midportion and becoming slightly heavier in its alveolar region. It is heaviest after the third molar has developed, thus forming the maxillary tuberosity.

Fig. 7.—Third molar in infratemporal fossa

The lower part forms the anterior boundary of the infratemporal fossa, and the upper part forms the anterior boundary of the pterygopalatine fossa. The center of the surface is pierced by the openings of the posterior superior alveolar canals for transmission of the posterior superior alveolar nerves and vessels to be distributed to the maxillary molar teeth (Fig. 8, left).

The boundaries of the pterygopalatine fossa (sphenomaxillary fossa) are: superiorly, the undersurface of the body of the sphenoid and the orbital process of the palatine bone; anteriorly, the infratemporal surface of the maxilla; posteriorly, the base of the pterygoid process and lower part of the anterior surface of the greater wing of the sphenoid, and medially, the vertical part of the palatine bone with its orbital and sphenoidal processes.

The boundaries of the infratemporal fossa (zygomatic fossa) are: anteriorly, the infratemporal surface of the maxilla and the descending ridge of the zygomatic process; posteriorly, the articular tubercle (eminentia articularis) of the temporal bone and the spina angularis of the sphenoid; superiorly, the greater wing of the sphenoid below the infratemporal crest, and the undersurface of the temporal squama; inferiorly, the alveolar border of the maxilla, and medially, the lateral pterygoid plate.

The infratemporal fossa is the one of greatest interest to the oral surgeon. Operations on the third molar, the maxillary tuberosity, or on tumors and fractures of the posterior surface of the antrum may involve the contents of this fossa.

Situated below and medial to the zygomatic arch the infratemporal fossa contains the lower part of the temporal muscle, the internal and external pterygoids, the

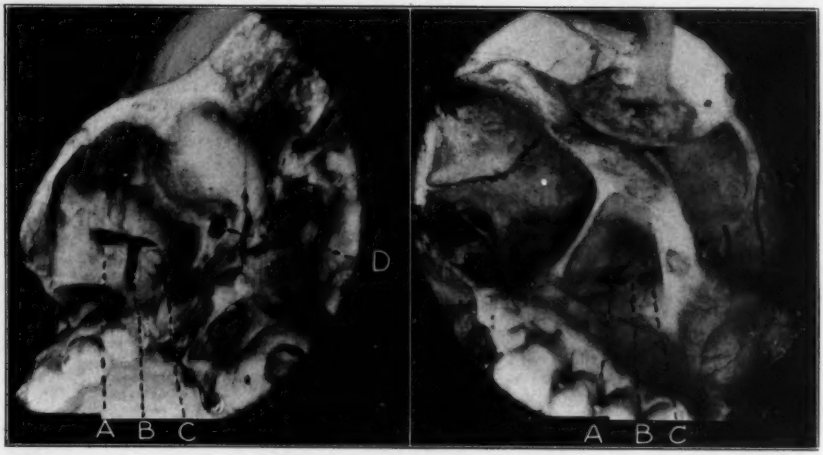

Fig. 8.—Left: Infratemporal surface of maxillary sinus, showing (A) inferior orbital fissure, (B) pterygomaxillary fissure, (C) posterior superior alveolar nerve and vessels and (D) foramen ovale. Right: Medial surface of maxillary sinus, showing (A) ostium maxillare, (B) uncinate process and (C) accessory opening into sinus

mandibular and maxillary nerves and some of the branches of the internal maxillary vessels.

Hemorrhage caused by injury to one of the vessels, anesthesia or paresthesia, if the nerves are injured, and trismus resulting from muscle injury or infection are the complications which may arise.

Infections may take the course along the sheath of the mandibular nerve and enter the meninges and brain through the foramen ovale which opens on the roof of this fossa.

The pterygopalatine fossa can be entered from the infratemporal fossa through the pterygomaxillary fissure. The fissure transmits the terminal part of the internal maxillary vessels and forms part of the contents of the fossa together with the maxillary nerve and the sphenopalatine ganglion.

In its passage through the pterygopalatine fossa the maxillary nerve gives off two short sphenopalatine nerves which pass above and lateral to the sphenopalatine ganglion. A number of small filaments from the sphenopalatine nerves enter into the ganglion itself.

Just before the maxillary nerve enters the infra-orbital canal in the roof of the maxillary sinus it gives off one and sometimes two posterior superior alveolar nerves which traverse the infratemporal surface of the sinus downward to enter the posterior alveolar foramen.

The importance of knowing the contents of the pterygopalatine and infratemporal fossae is obvious.

Medial or Naso-Antral Wall

The oral surgeon's interest lies in the opening for communication between the sinus and nasal cavity and in the lower third of the surface where artificial antro-nasal drainage may have to be established.

The antral surface of the naso-antral wall permits entrance into the middle meatus of the nose in the living state, through an opening in the upper part of the sinus. In the disarticulated skull, two or more openings may be present (Fig. 8, right). A probe passed from the sinus through the opening in the medial wall goes through the ostium maxillare into the hiatus semilunaris.

The ostium maxillare is the natural orifice of the maxillary sinus. In 80 per cent of cases the orifice is actually a canal measuring from 2 to 4 or 5 mm. in length. In shape it may be irregularly round, ovoid or a thin slit.[5] The rest of this surface is rather smooth and marked only by ridges representing the nasal conchae. The lower third is thin and is easily broken through to gain access to the nasal cavity.

Examination of the nasal surface discloses the superior, middle and inferior nasal conchae with their corresponding meati. From the standpoint of the oral surgeon, the inferior meatus is of interest because of an area accessible for purposes of artificial drainage.

For entrance to the maxillary sinus through the nose a probe is inserted into the middle meatus, passing it below the bulla ethmoidalis and above the uncinate process of the ethmoid bone. The soft tissue cleft formed by these structures is the hiatus semilunaris. Following the hiatus with a probe posteriorly and superiorly will lead to the opening into the maxillary sinus.

Conclusion

Simple operative procedures involving the maxillary sinus may become complicated because of variations in size and shape of the sinus with its accompanying changes in anatomic relations.

Being thoroughly acquainted with the anatomy of the average aids one in the recognition of the anomaly.

The variations in the anatomy of the maxillary sinus from infancy to adulthood must be recognized if successful results in surgery are to be attained.—*311 Commonwealth Avenue.*

5. Simon, Emanuel, Anatomy of the Opening of the Maxillary Sinus. *Arch. Otolaryng.* 29:640 (April) 1939.

DOMINANT INHERITANCE OF CLEFT LIP AND PALATE IN FIVE GENERATIONS

Avery R. Test, Ph.D.,
and Harold F. Falls, M.D., M.S.,
Ann Arbor, Mich.

A large volume of literature[1-5] is available which both supports and disputes the theory of inheritance of cleft lip and cleft palate in man. In large series of cases,[6] some hereditary basis has been found in from 5 to 44.5 per cent of such series. Recent studies[7] have emphasized the influence of toxic, chemical and nutritional agents in the production of cleft lip and palate among the offspring of laboratory animals. It is accepted readily that developmental processes may be deranged by environmental agencies in a manner similar to the effect of genetic mutation. Unfortunately, despite intense study, it has often been impossible to determine whether a particular isolated case of a specific anomaly has been environmentally or genetically determined.

Many writers have been concerned over the fact that so many reported human pedigrees apparently fail to meet the requisites of a typical Mendelian inheritance pattern. In explanation of this discrepancy it may be emphasized that (1) in very few studies were all living members of a family carefully examined for aborted forms of the complex and (2) there has been a general failure to recognize the fact that apparently identical phenotypic defects need not have the same genetic basis, indeed may sometimes not even be genetic in origin.

Pedigree

Study of the family described here was first undertaken because of the interest stimulated by the occurrence of the very rare human anomaly of accessory salivary glands in the lower lips of several persons.

The family is chiefly of Welsh and Scotch descent and has resided in southeastern Michigan for at least four generations. The majority of the members shown on the pedigree have been day laborers or farmers.

The pedigree chart (Fig. 1) is of the conventional type. Siblings are arranged horizontally and in order of their birth. Each sibship is indicated by a Roman numeral, and each member of the family proper by an Arabic numeral. Combinations of these numbers are used to identify persons in the text.

Junior geneticist, Department of Human Heredity, University of Michigan.

Assistant professor of ophthalmology, assistant geneticist in the laboratory of vertebrate biology, and research associate, Department of Human Heredity, University of Michigan.

1. Rischbieth, H., Harelip and Cleft Palate. *Treas. Human Inher.* 4:79, 1910.

2. Berkenfeld, Werner, Uber die Erblichkeit der Lippenspalte und Gaumenspalte. *Arch. f. klin. Chir.* 141: 729, 1926.

3. Schröder, C. H., Eineige Zwillingen mit Hasenscharte und Gaumenspalte. *Zentralbl. f. Chir.* 66:2299 (October 21) 1939.

4. Nebermuth, H., Uber die erbbiologische Bewertung der Lippen und Gaumenspalte. *Arch. f. klin. Chir.* 193:224, 1938.

5. Mather, K., and Philip, N., Inheritance of Harelip and Cleft Palate in Man. *Ann. Eugenics.* 10:403 (December) 1940.

6. Sanders, J., Inheritance of Harelip and Cleft Palate. *Genetica* 15:433 (January) 1934.

7. Warkany, J.; Nelson, R. C., and Schraffenberger, E., Congenital Malformations Induced in Rats by Maternal Malnutritional Deficiency. *Am. J. Dis. Child.* 65:882 (June) 1943.

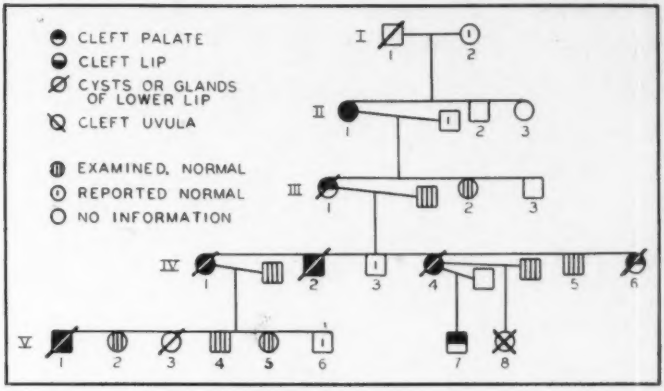

Figure 1

Pathologic Notes

I-1.—Very little information is available concerning this gentleman other than that obtained from studying an old photograph and that supplied by his granddaughter (Fig.2). A marked thickening of his lower lip is demonstrated by the photograph, as well as the typical bilateral dimpling of accessory salivary glands lateral to the midline on the vermilion surface. No nasal intonation or unusual structure of the upper lip was recalled.

II-1.—This woman was known to have had a cleft lip on the right side and cleft palate which were never repaired. The presence of accessory salivary glands was not recalled by the family, and her photographs do not suggest their presence. No associated skeletal or physical anomaly was known.

III-1.—Examination of this woman, aged 58, revealed an untreated cleft palate which involved the midline and included the posterior two-thirds of the bony and soft palate. The patient was edentulous, but no anomaly of the dentition was recalled. She was of a fair level of intelligence and alert, and kept a clean, neat home. She seemed very reticent to discuss her parent's and grandparent's anomalies.

IV-1.—This woman, aged 30, was first seen at the Oral Surgery Clinic of the University Hospital on August 12, 1911, when she was 4 years old, at which time diagnoses of cleft palate, cleft lip on the right side and accessory salivary glands of the lower lip were made. The latter were represented chiefly by thickening of the lips, since only minute orifices were demonstrable. Cheilorrhaphy and palatorrhaphy were performed. There was moderate cosmetic improvement. The patient was not seen again until 1943, at which time a small circular central defect was present in the midline of the palate. No uvula was demonstrable. There was no specific dental anomaly other than a poorly developed right lateral incisor and a small cuspid tooth. There were extensive dental caries. The level of intelligence was poor. The patient's personal appearance, like that of her home and children, was very unsatisfactory.

IV-2.—This man, aged 38, was first seen at the Oral Surgery Clinic on August 16, 1911, when he was 3 years old, at which time diagnoses of bilateral cleft palate and lip and accessory salivary glands of the lower lip were made. The latter were extensive, with large duct-like openings through which rather copious amounts of mucus could be expressed. Palatorrhaphy and cheilorrhaphy were performed in three successive stages. There was moderate improvement in appearance and voice function.

IV-4.—This woman, aged 32, was seen at the Oral Surgery Clinic on December 6, 1920, at which time cleft palate and lip on the right side and accessory salivary glands of the lower lip

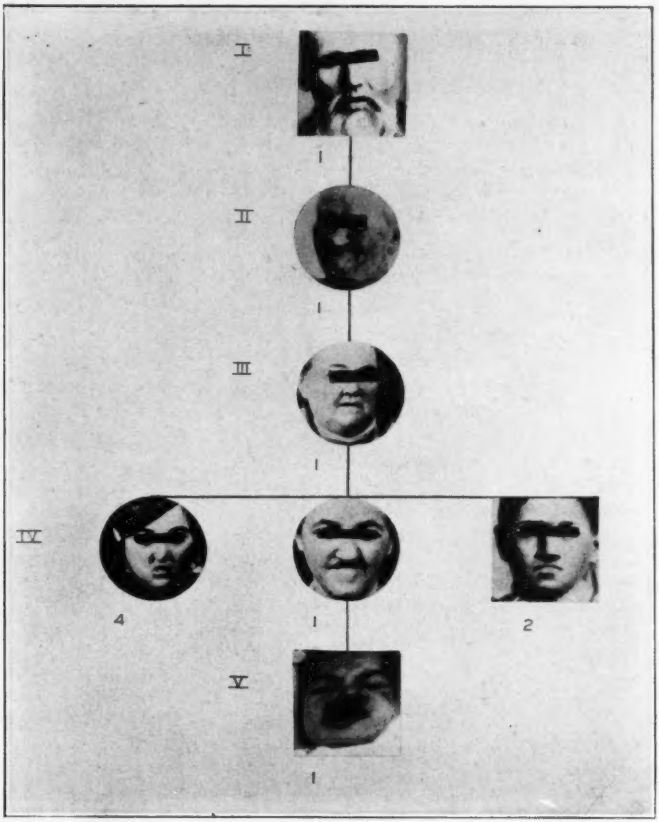

Figure 2

were diagnosed. The large salivary glands in the lower lip had small orifices on the vermilion border of the lip, one on each side of the midline. Results of surgical repair were only fair and resulted in a rather short palate, scarred upper lip and a flattened, broad nose.

IV-6.—This woman, aged 23, has had no surgical treatment. The midline cleft of the palate was rather wide and involved all of the soft palate and the posterior third of the hard palate. The lower lip showed quite well developed accessory salivary glands. The voice was resonant and high pitched.

V-1.—Surgical treatment for cleft lip and palate on the right side was begun for this boy, aged 13, when he was 7 weeks old. He enjoys an excellent cosmetic result. A large single salivary pit with a small orifice to the right of the midline of the lower lip was noted. The lower right lateral incisor and cuspid were small and underdeveloped. No other skeletal or physical anomaly was observed.

V-3.—This girl, aged 9, showed no anomaly of the upper lip or palate. (For this and the cases that follow, refer to Figure 1.) There were moderately sized accessory salivary glands in the lower lip. The pit on the right side of the midline was the only orifice observed. Transillumination of the glands was possible. No skeletal or physical developmental anomaly was noted.

V-7.—The relatives of this boy, aged 16, considered him to be normal for the trait. Careful examination and observation of the palatal function revealed a failure of union and of action of the uvular musculature at the midline. Palpation of the soft palate indicated that a cleft existed centrally in the muscle body but that the gap had been bridged by union of oral and nasal mucous membranes.

It is probable that this defect is similar to the more frequently observed scar of the upper lip, which also lacks union of the lip musculature.

V-8.—This girl, aged 14, was seen in the Oral Surgery Clinic on May 8, 1943. A bifid uvula was noted but no cleft of either the hard or soft palate was exhibited. The nasolabial folds were very deep, suggesting possible late closure. A moderately sized accessory salivary gland was present at the midline in the lower lip.

Heredity of the Complex

The association of accessory salivary glands of the lower lip with the cheilognathouranoschisis complex has been described by Straith and Patton[8] but has not been recognized by all investigators as a manifestation of the same gene that affects the entire complex. The presence of pits in this family as in others suggests that they are a part of the syndrome.

In cases in which the minor manifestations of the cheilognathouranoschisis complex are searched out, as in this family, it becomes possible to determine the pattern of inheritance. In this pedigree the complex as a whole demonstrates the typical pattern of dominant Mendelian inheritance. The degree of dominance of the complex, however, varies greatly among affected persons as does the expression of the various aspects of the complex. The gene, however, does exhibit sufficient dominance to fulfill the requisites of dominant inheritance of an irregular type. There is no evidence of sex linkage, sex limitation or sex influence. There is no evidence in favor of the often expressed idea of greater frequency of affected males.

We found 4 males and 5 females with cleft palate; 2 males and 3 females with harelip; 3 males and 5 females with accessory salivary glands, and no males and 2 females with cleft uvula.

Although these figures are too small in number for statistical treatment, it is obvious that they fall well within the expected deviation from the normal 1:1 ratio of the ordinary Mendelian dominant. The number of males who show any expression of the syndrome, however, seems somewhat low (4) when compared to the number of females similarly affected (7). It is to be noted that this deviation in favor of more affected females than males is in contradiction to the usual finding. It should be noted that among total offspring of affected parents in this pedigree there is a slight preponderance of female to male (11 females to 9 males).

A point of special interest is the variable expression of the complex among the affected persons. Cleft palate, mild or severe, with accessory salivary glands; cleft palate and cleft lip with or without accessory salivary glands, and accessory salivary glands alone were observed in the affected group. Singly or in combination, these anomalies indicate that the affected person, no matter how mildly involved, is capable of transmitting the trait in either severe or mild form to approximately half of his or her offspring.

It should be noted particularly that a person who is but mildly affected (I-1) can pass the trait in the most severe form (II-1); and, in reverse, a person who suffers from the severe expression (IV-1 and IV-4) may transmit the mildest expression

8. Straith, C. L., and Patton, H. S., Bilateral Congenital Mucous Cysts in Three Generations. *J.A.M.A.* 123:693 (November 13) 1943.

(V-3, V-7 and V-8) or the most severe (V-1) to his or her offspring. Therefore, it is our belief that the severity of the trait in a parent is no indication of the severity which may be expected in the offspring, and there most certainly is no "acceleration."

This phenomenon of variable expression of a gene is rather common in human heredity but is especially prevalent in the syndrome under discussion. Many parents who bring us a child with cleft palate and/or cleft lip are amazed when we point out that they themselves are likewise minutely affected (perhaps a congenital scar of the upper lip, a flattened nose, or an accessory salivary gland). In performing studies of this nature, the field workers must be most meticulous in examining all living members of the family, because only then is it possible to uncover slight or unusual manifestations of the given anomaly.

Socio-Economic Aspects of the Defect

This kindred provides an excellent example of the socio-economic handicap of a defect which is severely disfiguring and/or provides a social disadvantage. For at least three generations the effects of this handicap, both on economic opportunities and in the choice of mates, have been strikingly apparent.

In every case, the members of the kindred who show a severe disfigurement (unrepaired or poorly repaired cleft lip) have no choice of job but can only take what remains after every other available person has been employed, whereas other members of the family fare much better in this respect. It might be suspected that there is a difference in ability between the normal and affected members, but this seems not to be so. The lack of difference in ability is illustrated graphically by several events. First, during the recent war, when labor was never adequate to fill the jobs, even the most disfigured members were able to obtain and hold jobs successfully in a factory where the work was of a rather highly skilled type. Even then, however, every other employable person in the community had a choice of jobs before the factory was willing to employ disfigured members of this kindred; although, once employed, some of these latter rapidly surpassed their more personable fellows in accomplishment. Of considerable interest is the fact that the members of the family who are not badly disfigured, but merely have a marked impediment in speech because of cleft palate only, can obtain jobs much sooner and thus of a better type than can their disfigured relatives. As long as the job does not require any use of speech, the persons with only cleft palate can succeed financially and hold their jobs fairly well, facts reflected in their greater prosperity. Whereas the homes of the disfigured members (IV-1, IV-4 and II-1) have been squalid huts, without comforts, adequate space or modern conveniences and located inevitably in the worst part of the town, the homes of the defectives who do not suffer disfigurement (III-1 and I-1) have been of a much better classification, well kept, clean, with nice furniture, many modern comforts and conveniences. Still further up the socio-economic scale are the homes of the normal members of the family (III-2 and IV-3). These have been the homes of moderately successful people, located in good parts of town, modern and up-to-date, showing every evidence of care and prosperity.

Further, there is striking evidence that the degree of revulsion caused by the expression of the defect also controls choice of a mate. I-1 was able to marry a normal, educated woman who was industrious and able. His daughter II-1, although a member of a prosperous family prominent in the town's activities, had no such fortunate choice available to her. She married a day laborer with neither education nor ambitions. This branch of the family promptly started to descend socially and economically, whereas the siblings of II-1 were able to choose mates of a social and

economic level equal to their own, and to remain on that plane. Of the offspring of II-1, III-1, moderately defective in that her cleft palate affected her speech, was able to improve her status somewhat over her mother's. She also married a man who was a day laborer but who was sober, industrious and capable of fairly wise management of the funds he was able to make. He provided a nice little house and furniture, some modern conveniences and even a car. III-2, on the other hand, being normal, was able to better her social and economic level even further by her marriage. In fact, she was able to raise herself again to the level from which her mother had fallen at marriage. IV-1, a repulsively disfigured woman, married a man who, although handsome, is a ne'er-do-well of the first order, a poor provider with no ambition and no drive. IV-2 has not married. IV-3, normal, has married a normal woman and has been able to give her a better than average home in a fine neighborhood in another town. He has found it expedient to withdraw from his family so as not to be retarded socially by them. IV-4 has married twice, but both times to a day laborer of the most unambitious type. She is ambitious but had not been able to obtain work until the dearth of labor during the past war.

The overall picture presented by this group is thus striking in its contrasts and illustrates only too graphically the socio-economic disadvantage of a disfiguring defect.

Summary

A pedigree of dominantly inherited cheilognathouranoschisis complex is reported. The marked variation in degree of expression of the gene is emphasized.

Attention is called to the fact that accessory salivary glands of the lower lip may be an expression of the cheilognathouranoschisis complex.

The notable socio-economic handicaps imposed by such a defect are illustrated, as is the handicap gradient depending upon severity of disfigurement.—*Department of Human Heredity, University of Michigan.*

PREOPERATIVE AND POSTOPERATIVE CARE IN ORAL SURGERY

Daniel J. Holland, Jr., D.M.D.,
Boston

All surgical procedures, whether of major or minor import, must be based on sound scientific foundations, or the gamut of complications, some more serious than others, is inevitable. All oral surgery is potentially major surgery, and to deviate in any degree from basic principles in the execution of an oral surgical procedure is to court complications.

In a well executed operative procedure it is unwise to relegate preoperative and postoperative considerations to levels less important than those occupied by the technical aspects of the operation itself. Careful preoperative study, diagnosis, and treatment planning; the actual mechanics of the operation, and meticulous postoperative care and follow-up examinations are three inseparable, equally important phases which are the direct responsibility of any oral surgeon and the right of any patient.

Too often the surgeon's interest is focused on the mechanics of the operation, and preoperative analyses are shunted. Too often, after the accomplishment of the operation, the surgeon loses interest, and postoperative care is neglected. The postoperative complaints of the patient warrant the same interest as that given the preoperative complaints which led to the operation. When an oral surgeon accepts a patient he also must accept the obligation and the responsibility to see the case through to the end, to his own and the patient's satisfaction. His preoperative planning must be serious, scientific and complete; his interest must not lessen with placement of the last suture or application of the postoperative dressing. His job is not completed until the patient is either cured or relieved, to the utmost of the operator's ability.

Oral surgical procedures are neither easy nor without mortality. The ratio or incidence of the associated morbidity and mortality is directly proportional to alertness in diagnosis and expertness in treatment. We all appreciate that failure to recognize the significance of some seemingly minor sign or symptom may have grave consequences. Simple tooth extraction may be a serious and formidable undertaking if the patient has uncontrolled diabetes, hidden cardiovascular disease, advanced liver dysfunction, blood dyscrasia or other systemic anomalies.

The oral surgeon must be a student of disease. The great surgeon Halsted stated that a surgeon must use his head as well as his hands. If he uses only his hands he becomes an operator who practices a handicraft, because he loses sight of the reason why. And so, in our preoperative considerations we should concentrate on the why of the problem at hand.

History

In the evaluation of why, it is elementary to stress the importance of a complete history. To be of most assistance the history should be detailed and should follow

Read at the twenty-ninth annual meeting of the American Society of Oral Surgeons, Boston, July 31-August 2, 1947.
Assistant oral surgeon, Massachusetts General Hospital, Boston.

the accepted and established form, listing chief complaint, present illness, past history and family history. The history is the beginning of the diagnosis, and here may flash the warning signs and danger signals. While taking the history, one should have in mind the myriad systemic diseases which might contribute to the problem at hand or influence the approach to its correction.

Examination

A detailed regional examination of the mouth and its surrounding structures is next, as well as a brief review of the various systems, with emphasis at points on which further study seems indicated. Every possible contributory piece of evidence derived from the history should be brought to the front.

Then should come the impression, which is not the final diagnosis but the mental exercise of interpretation, analysis and deduction of the material at hand. True, many cases will need no further preoperative concentration, for the pathogenesis and diagnosis will be clear. However, other cases will require, besides roentgenograms, certain laboratory aids, such as blood studies, urinalysis and biopsy, and/or consultants' opinions. As no man any longer may be experienced in and completely informed regarding the entire field of medicine and surgery, we should use the acumen of the laboratory technician, the internist or other specialist more freely.

Oral surgery may well be at the crossroads. Whether it will grow in stature and respect under the aegis of dentistry, or whether it will undergo mutation to medicine may well depend on how maturely oral surgeons execute the preoperative diagnostic aspects of the why.

Once the diagnosis has been established and, when possible, confirmed, and the patient's general health has been thoroughly investigated and necessary corrective measures instituted, the next consideration is the how. An understanding of this consideration requires an evaluation of the seriousness of the operation, in order to determine how the patient should be taken care of, either in the office or in a hospital. In making the decision, one must not only think of the incapacity which will result from the operation and from the anesthesia required to perform it, but one must also evaluate the patient's ability to withstand the procedure and whether special supportive treatment and trained attendants are required.

Preoperative Considerations

For minor surgical procedures carried out under local anesthesia in the office no special preoperative orders are necessary for the average patient. Patients with diabetes, cardiac disease, hemophilia or rheumatic fever require special preoperative consideration for office procedures, usually in cooperation with the family physician. In the New England section, premedication of ambulatory office patients is not as common as in other sections. Unless the patient is accompanied, and unless his transportation is arranged, premedication—even with pentobarbital sodium, Seconal sodium (Lilly) or analgesic levels of nitrous oxide—is not entirely safe. If general anesthesia is employed in the office, empty stomach and bladder are requisites.

For hospitalized patients preoperative written orders are routine. The purpose of these preoperative orders is (1) to prepare the patient as completely as possible for the surgical procedure; (2) to insure his comfort and safety, and (3) to minimize complications.

In most of the large hospitals of the country the anesthesiology departments are now well staffed by competent medical anesthesiologists, and a preoperative con-

sultation regarding the type of anesthesia to be used will pay good dividends. At the Massachusetts General Hospital, in which ether is usually the anesthetic of choice, all oral surgical operations are performed with the patient under ether administered by endotracheal intubation, unless, of course, endothermy or other electrical treatment is used. Present statistics confirm that the risk connected with thiopental sodium anesthesia for oral surgical procedures is far greater than the risk connected with ether anesthesia.

On the patient's admission to the hospital a routine urinalysis is made. The diabetic patient should go to the operating room well nourished, with the liver well stocked with glycogen and the urine free of acid and containing little or no sugar.

Preoperative Orders

Preoperative orders are usually written in the order book by the hospital intern but should be checked by the attending oral surgeon. My routine preoperative orders for hospitalized patients are as follows:

1. Soapsuds enema the night before operation.
2. Pentobarbital sodium 0.1 gm. or subcutaneous injection of phenobarbital 0.13 gm. at bedtime.
3. Nothing by mouth after midnight. No breakfast. If the operation is to be performed in the afternoon, breakfast of orange juice or coffee and one slice of toast may be allowed.
4. Oral hygiene. The teeth should be brushed and the mouth washed frequently with a weak solution of hydrogen dioxide. If an extra-oral surgical approach is planned, the skin at the operative site should be shaved or prepared as necessary.
5. Penicillin, 50,000 units every 6 hours, or chemotherapy as indicated.
6. Subcutaneous injection of atropine 0.43 mg. or 0.6 mg., if necessary, about 40 minutes before the anesthetic is to be administered. (If the patient is not in pain, morphine is not necessary as preoperative medication. It is a respiratory depressant and a traditional hangover from the days when anesthesia was incomplete and narcosis was provided preoperatively.)
7. The time and nature of the operation and the contemplated anesthetic agent are recorded.

Postoperative Considerations

The purpose of postoperative care is (1) to insure and safeguard the corrections made at the operation; (2) to provide maximum safety and comfort for the recovering patient; (3) to prevent and minimize postoperative complications, and (4) to restore to full function as quickly as possible the patient and the part that has been operated on.

The principal considerations in postoperative care are rest, water requirements, electrolyte needs, blood loss factors, food, vitamins, elimination and the management of complications. These considerations should not be left to the discretion of the attending nurse but should be carefully investigated and checked by the attending oral surgeon.

Ambulatory Patients

It is understood that the ambulatory office or clinic patients are, as a rule, healthier than those in the hospitalized group, and the oral surgical procedures performed on them are minor as contrasted with those more extensive or serious procedures

carried out in the hospital operating room. Therefore, the postoperative treatment for patients in this group is simple but no less important than that for patients who have had major oral operations.

Postoperative orders given at the end of the operation cover the immediate need of the patient and the period of recovery from the anesthetic until consciousness is regained and reactions are normal. Subsequent postoperative care is managed according to the progress made by the patient. Written or printed postoperative orders are advantageous for office or clinic patients who frequently forget the verbal instructions given.

Pain retards recovery and causes exhaustion. Medication should be prescribed which is adequate for the degree of distress. Such medicine might include aspirin 10 grains (0.65 gm.) with acetylsalicylic acid-acetophenetidin-caffeine compound 10 grains; codeine ½ grain (32 mg.); codeine 1 grain with aspirin 10 grains; meperidine hydrochloride 100 mg., and morphine ⅛ to ⅙ grain (8 to 10 mg.). This latter drug is the most reliable means of alleviating pain. In those cases in which it produces nausea or sensitivity, Pantopon (Hoffmann-La Roche) ⅓ grain may be used.

Nervousness and restlessness accentuate discomfort and lower pain thresholds. Hypnosis rather than narcosis is desired. If sleeplessness is not caused by pain the following drugs are useful: pentobarbital sodium 1½ grains (0.1 gm.); Seconal sodium (Lilly) 1½ grains (0.1 gm.), and phenobarbital 1½ grains (0.1 gm.).

Hydrotherapy

In oral surgery, perhaps more than in other surgical specialties, hydrotherapy is frequently employed. The intra-oral and extra-oral accessibility of the jaws, the thinness and vascularity of the soft tissue parts of the face and the ease of application of either heat or cold have contributed to the universality of this modality. An additional factor, no doubt, has been the deep concern of the patient to prevent swelling about the face as an aftermath of operation and to abort the swelling associated with facial infection. Both dentist and surgeon have a healthy respect for facial infection and for the serious sequelae to extension of such infection and have been eager to employ hydrotherapy as both a preventive measure and an active agent.

Cold is used to reduce swelling caused by trauma, not infection. To be most effective the cold must be applied early before lymphatic edema sets in. Local cold applications or ice bags cause a diminution of capillary blood flow; the number of open capillaries is decreased; tissue metabolism is reduced, and the normal rate of exchange between blood and the tissues is decreased. Treatment with cold applications in oral surgery has much more limited use than application of heat and should be used (1) immediately after trauma to the face or jaws, to reduce swelling and minimize the accumulation of tissue fluids and exudates; (2) as a postoperative procedure in odontectomy, reduction of fractures, alveolectomies, apicoectomies, ridge extensions and other surgical procedures in which infection is not a factor, and (3) for relief of pain in pulpitis and neuralgia. Cold has decided surface analgesic effects and penetrates tissue better than heat.

Exposure of a wounded part to heat is instinctive in animals, and man has incorporated heat into various forms of treatment in the healing art for centuries. The depth of penetration of heat applied in the form of poultice, compress or hot water bottle is not greater than a few millimeters. Heat is quickly dissipated by the tissues through the action of circulatory reflexes, which is why such large quantities

of heat energy are required to alter the temperature of tissue to any depth. Local exposure to heat results in stimulation of the vasomotor reflexes. The number of open capillaries is increased, tissue metabolism is accelerated and the rate of exchange between blood and tissues is increased. Hence, more lymph, plasma and tissue fluid are attracted to the part. Thus the physiologic need for heat in the presence of infection seems clear.

If the postoperative infection is markedly pathogenic and is inclined toward formation of pus and localization, either intra-orally or extra-orally, heat will hasten the process. Conversely, if the infection is inclined toward resolution rather than localization, heat will hasten the resolution.

Dentists have been prone to avoid prescribing heat for obvious dental infections in the presence of secondary cellulitis and have recommended cold. Ice bags never prevent infection and frequently prolong the duration of the infection by inhibiting the natural defense mechanism of the tissue.

The most effective extra-oral agent is the old-fashioned flaxseed poultice applied every two hours. If properly prepared and applied, flaxseed gives maximum penetration and duration of heat. Intra-oral heat is probably best administered in the form of hot irrigations of normal saline solution at 120 to 125 F. Irrigations are better than mouthwashes because the mechanical lavage is more forceful and effective.

Diet

Postoperative diet for the oral surgical patient deserves high priority and should be planned carefully according to the extent of the operation performed. The food intake should be checked, as regeneration, repair and regaining of strength depend not on what is served on the tray but rather on what actually is consumed. If the services of a dietitian are available they should be used freely in the planning of special diets, well balanced and suitable for the particular patients. Immediately postoperatively, if ether anesthesia has been used, I withhold all fats and prescribe liquids until the patient is no longer nauseated. As the fat metabolism is temporarily disturbed, patients have less nausea, vomiting and distress for twelve to twenty-four hours after the anesthesia if only clear liquids such as fruit juices, water, tea and clear broth are served. As soon as all nausea has subsided a diet which can be tolerated by the patient is prescribed.

Usually, because of the nature of the oral surgical procedure, postoperative discomfort requires a soft diet or a high caloric, high vitamin liquid diet of 3,000 calories (3,000 cc.) supplemented by 1 or 2 multiple vitamin capsules a day.

Lanman and Ingalls,[1] in 1937, showed that vitamin C deficiency leads to poor healing of wounds. We also know that prolonged infection depletes the stored vitamin reserves. Therefore, I strongly recommend supplementary vitamin treatment for the recovering oral surgical patient. I prescribe multiple vitamin capsules and reinforce with vitamin C in the form of ascorbic acid 200 to 300 mg. a day. Beer may be prescribed as a source of vitamin B but one or two tablespoons of syrup of vitamin B complex is a more potent source.

Vitamin K, the antihemorrhagic vitamin, has to do with the metabolism of prothrombin, the precursor of thrombin. This may be administered in the form of menadione sodium bisulfite, about 5 mg. a day.

Necessary adjustments must be made for diabetics made edentulous. They must be reregulated on a low carbohydrate liquid diet or one containing very soft solids.

1. Lanman, T. H., and Ingalls, T. H., Vitamin C Deficiency and Wound Healing. *Ann. Surg.* 105:616, 1937.

Food intake should be in excess of energy requirements, and, if regeneration and repair of tissues are to be facilitated, there must be provided a sufficient amount of an adequate protein in the diet after operation. Maximal tissue regeneration and repair cannot occur if the diet consists of foodstuffs from which cellular repair cannot easily take place.

General Care

Elimination is another important postoperative consideration for patients whose regular bowel habits have been altered. As a rule, one of the following laxatives is effective: cascara tablets (0.19 gm.) one or two at bedtime; mineral oil (30 cc.) once a day, or milk of magnesia and mineral oil (15 cc. each) once a day. These failing to produce results, a warm soapsuds enema should be ordered.

Oral hygiene, although simple, should not be overlooked, and, unless specifically ordered in the order book, may be neglected. Irrigations, mouthwashes or gentle brushing of the teeth all help to keep the mouth as clean as possible, maintain tissue tone and directly influence the regeneration of tissue and the reduction of infection. Physiologic saline solution, Dobell's solution (aqueous solution of sodium bicarbonate, borax, phenol and glycerin), Dakin's solution, weak aqueous solution of hydrogen dioxide or hexylresorcinol are effective.

Chemotherapy or treatment with antibiotics is of paramount importance and is indicated in the presence of infections and as a preoperative and postoperative prophylactic measure. Such treatment is more difficult to carry out, however, on office or clinic patients. If the infection is severe or extensive, hospitalization is preferable to home treatment.

Identification of the pathogens and tests for their specific sensitivity to treatment with antibiotics are refinements in careful treatment.

Hospitalized Patients

After major oral surgical operations performed under general anesthesia, the routine orders that follow should be dictated by the surgeon to the anesthetist and should be checked and signed by the surgeon at the completion of the operation.

1. Take blood pressure and pulse every ½ hour for two hours, then every two hours until constant.
2. Turn the patient on alternate sides every hour until conscious.
3. Place patient on medium headrest when conscious.
4. Encourage deep breathing.
5. Give liquids without fat freely until the patient is no longer nauseated.
6. Meperidine hydrochloride 100 mg. or morphine 10 mg. subcutaneously every four hours as necessary.
7. Special orders for hygiene, dressings and hydrotherapy.

If there is postoperative shock or loss of blood resulting from the operation, the administration of blood by transfusion often is indicated during protracted convalescence, to supply hemoglobin, protein and antibodies. This is particularly true after long operations in which loss of blood has been significant, and in the presence of both acute and chronic infections such as osteomyelitis, in which the antibody reserves have been depleted or were insufficient.

In dealing with blood dyscrasias such as anemia, leukemia, thrombopenic purpura and hemophilia, several small transfusions of 200 or 300 cc. are more effective than one or two large transfusions. If blood bank service is available, as in the larger hospitals, it should be utilized.

Maintenance of a proper water balance postoperatively is vitally important, particularly for oral surgical patients who are unable to take 2,500 to 3,000 cc. of fluid a day by mouth. Disregarding the volume of the fluid intake and permitting varying degrees of dehydration to occur is a common error. Enough water must be available to supply the tissue cells with the requisite amount of fluid. Taking of too much fluid, however, is particularly hazardous to older patients with impaired cardiac reserve.

Intravenous administration of 1,500 cc. of 5 per cent dextrose in water, given at the rate of 60 to 80 drops a minute, is excellent supplementary treatment during long operations, particularly if the patient is under thiopental sodium anesthesia. It is possible to feed patients intravenously for long periods of time, supplying carbohydrate in the form of dextrose, proteins in the form of simple amino acids such as Amigen (Mead Johnson), vitamins in the form of ascorbic acid and vitamin B complex and the correct amount of sodium chloride and other electrolytes. The very ill patient, who preoperatively has had inadequate fluid intake and who has a dry skin, dry tongue and obvious dehydration, must be prepared by intravenous treatment. Computing the twenty-four hour output of urine after operation is a simple method of judging the patient's fluid requirements. The intravenous treatment should be maintained until adequate intake by mouth is possible. Due allowance must be made for the increased requirements incident to sweating, vomiting, diarrhea and fever.

The technical aspects of the operation are important, but rare surgical skill is no substitute for studied preoperative analyses and meticulous postoperative care. The preparation of the patient for operation and his guidance during recovery consist of a number of details contributing to a successful final result for the patient and the oral surgeon.—*1180 Beacon Street, Brookline, Boston.*

Reconstruction of Bony Defects of the Face, With Special Reference to Cancellous Iliac Bone. Douglas W. Macomber, in *Surg., Gynec. & Obst.* 83:761 (December) 1946.

1. For correction of contour defects and bony losses in facial structures, several substances are available. It is my opinion that all of the foreign substances should be abandoned.

2. Homogenous preserved cartilage has its useful place, particularly in replacing lost ear cartilage and in other relatively minor defects where strength or support is not a significant requirement. It should be taken from a proved "clean" donor under aseptic conditions, preserved in antiseptic solution changed occasionally, refrigerated, and cultured every 2 or 3 weeks.

3. Fat is practically useless except as a local attached subcutaneous pedicle for small depressions.

4. Fascia lata is sometimes preferable for shallow depressions and probably serves more safely and dependably than de-epithelialized skin.

5. Iliac cancellous bone is a singularly dependable, utilitarian, safe and satisfactory tissue for correction of the types of defects that have been discussed.

MANAGEMENT OF ANESTHESIA FOR ORAL SURGICAL OPERATIONS ON THE HOSPITALIZED PATIENT

Julia G. Arrowood, M.D.,
Boston

In general, the problems met during the management of anesthesia in oral surgical operations on the hospitalized patient are the same as those encountered in the course of anesthesia for any operative procedure.

Three conditions must be fulfilled in the administration of each anesthetic. In order of their importance they are (1) safety of the anesthesia, which must not increase the hazard of operation; (2) provision of adequate relaxation to afford suitable working conditions for the surgeon, and (3) comfort for the patient.

In addition to these fundamental demands there are difficulties peculiar to the work of the oral surgeon because his technical needs and those of the anesthetist may conflict.

The Preoperative Period

It is my opinion that if a patient is to undergo any operation of a magnitude sufficient to keep him in the hospital for the following night, he should be admitted to the hospital the afternoon preceding operation. This offers an opportunity for the recording of an adequate history, physical examination of the patient and laboratory examination including at least urinalysis and an estimation of per cent of hemoglobin and clotting time of the blood. The anesthetist should visit the patient in order to evaluate for himself the general physical status and should see the contemplated surgical field in order to estimate how the local situation will affect his choice of technic. This visit affords the patient an opportunity to know the anesthetist, to ask questions and to offer any information he wishes to give. The visit is often of considerable importance to the patient and is reassuring to him.

It is advisable that the anesthetist then confer with the surgeon to find out precisely what procedure is to be carried out, and the exact location, extent and approach. Technical excellence in the management of anesthesia for oral operations can be achieved only by painstaking attention to minute details and the application of accurate advance knowledge of the plan of operation.

Preoperative Medication

Preoperative medication is an integral part of the program of anesthesia and should be planned carefully for the individual patient with reference to the methods chosen in his case. Its object is to provide a comfortable preoperative period, free from apprehension, to reduce the metabolic rate and decrease reflex irritability, to minimize the secretion of saliva and mucus and to counteract undesirable physiologic and pharmacologic effects which may be produced by certain anesthetic agents.[1]

The plan usually followed is to administer a suitable dose of a barbiturate such as pentobarbital sodium to the patient at bedtime the night before operation and repeat it the next morning two hours preoperatively. Then, one hour before opera-

From the Boston University School of Medicine and the Smithwick Foundation of the Massachusetts Memorial Hospitals, Boston.

Read at the twenty-ninth annual meeting of the American Society of Oral Surgeons, Boston, July 31-August 2, 1947.

1. Adriani, John, *Techniques and Procedures of Anesthesia.* Springfield: Charles C. Thomas, 1947.

tion, morphine (or a similar drug) combined with atropine or scopolamine is given subcutaneously. If regional anesthesia is to be used, the doses of sedative drugs should be more generous than those given preceding general anesthesia. Following are certain specific indications and contraindications:

(1) Scopolamine produces an additive narcosis and amnesia when combined with morphine. It is preferable to atropine for use in patients who are to be subjected to regional anesthesia.[2]

(2) Atropine is preferable to scopolamine preceding the use of Pentothal sodium.

(3) In the presence of thyrotoxicosis scopolamine should be chosen in preference to atropine.

(4) If the patient has glaucoma, atropine and scopolamine are contraindicated.

(5) When the vital capacity is greatly decreased, by either pulmonary disease or deformities of the chest, any respiratory depressant, particularly morphine, is contraindicated.

Methods of Administration

If local or regional anesthesia can be used, it is preferable to any other type for oral operations. It has four advantages:

(1) It removes the anesthetist and his equipment from the operative field while the operation is in progress.

(2) The patient may be kept in a conscious state and is thus able to cooperate.

(3) The danger of aspiration of blood into the bronchial tree during operation and of vomitus during the postoperative period is reduced to a minimum.

(4) This type of anesthesia is free from undesirable side effects, except in the rare cases of sensitivity of the patient to local anesthetic drugs.

Unfortunately, in many cases the proposed operation is too complicated, painful and time consuming for successful performance under any type of regional anesthesia.

The alternative is a general anesthetic administered either intravenously or by inhalation. Occasionally, especially in children, basal narcosis by rectal administration of tribromoethanol may be resorted to, but in my opinion it is generally inadvisable. There is great variation in the height to which a given volume will ascend in different patients, when instilled by rectum, with consequent wide variation in speed of absorption. It is obvious that the greater the dispersion throughout the colon the more rapid the absorption and the greater the danger of severe depression or other untoward result.[3] At the same time, under these conditions, the drug is irrecoverable by washing out of the rectum. It is my belief that inhalation anesthesia affords better relaxation than intravenous anesthesia and is the safer of the two.

If the duration of operation is to exceed fifteen or twenty minutes it is advisable to use an endotracheal tube. This serves to guarantee a patent airway, protect against aspiration of blood and debris and give the surgeon a clear field.[4] The protection of the patient against anoxia and postoperative complications outweighs the danger of injury or morbidity which may be caused by the tube itself.

Intubation may be accomplished through either the mouth or the nose. The nasal tube is more convenient from the surgeon's standpoint. Oral intubation is safer because (1) it alleviates the danger of epistaxis; (2) the tube placed directly in the

2. Goodman, Louis, and Gilman, Alfred, *The Pharmacological Basis of Therapeutics*. MacMillan: New York, 1941.

3. Beecher, H. K., *The Physiology of Anesthesia*. New York: Oxford University Press, 1938.

4. Gillespie, N. A. *Endotracheal Anesthesia*. Madison: University of Wisconsin Press, 1941.

larynx is less likely to carry infection downward, and (3) a different type of tube in a larger size can be used, which reduces resistance in the airway, lessens likelihood of kinking or obstruction of the tube and offers better opportunity for suction. After the tube is in place, since it does not completely fill the larynx, a pharyngeal pack should be placed around it to make an airtight closure and to prevent aspiration. An alternative is use of a tube equipped with the Waters-Guedel inflatable cuff, a small balloon surrounding the tube. The balloon is empty when the tube is inserted and may be inflated with air after it is in place. It serves the double purpose of effecting an airtight closure around the tube and preventing blood and other material from entering the trachea. The objections to its use are that it increases slightly the difficulty of intubation, and cases have been reported in which it caused serious injury to the mucous membrane of the trachea by prolonged pressure.[5] When intubation is to be performed on the patient under Pentothal sodium anesthesia thorough topical anesthetization of the nasal mucous membrane, pharynx and larynx should be performed before induction is begun.[6] The use of Intocostrin or tubocurarine facilitates intubation, but has not been found necessary.

Agents

Of the inhalation agents, nitrous oxide and ethylene are the least toxic. Neither is sufficiently potent to produce complete relaxation if given with sufficient oxygen to prevent anoxia. They are the inhalation agents of choice for short procedures where little relaxation is required. Nitrous oxide is also useful as a supplement to intravenous anesthesia.

Cyclopropane affords good relaxation. It must be administered with a completely closed system, necessitating a cuffed endotracheal tube when it is used for oral operations. Pharmacologically the two points to be remembered are that cyclopropane does not depress the vagus nerve, so that active vagal circulatory and respiratory reflexes may be a source of danger; and that it sensitizes the conduction mechanism of the heart, increasing the danger of cardiac arrythmias.

Ether is an excellent agent for the production of relaxation. Its complications arise chiefly from its irritating qualities which affect the respiratory and gastrointestinal tracts. In normal patients any effect which may be produced upon the liver or kidneys is transitory.

Pentothal sodium is the agent most frequently employed for intravenous anesthesia. The drug is a profound respiratory depressant but does not depress the vagus reflexes. Hence, the accident most to be feared during its administration is respiratory failure either from the depression or from closure of the glottis and bronchiolar spasm caused by peripheral vagus stimulation.[7] Fatality may occur because resuscitative measures are either inadequate or tardily applied. For this reason it is mandatory that whenever Pentothal sodium is given three conditions be met: (1) a machine for administration of oxygen, under pressure if necessary, should be in the room; (2) efficient suction equipment should be in the room and ready for use, and (3) facilities for tracheal intubation should be instantly available if the operation is being performed without an endotracheal tube.

If the patient is well oxygenated at all times his circulation will continue unimpaired, in case of overdosage, and he will detoxify the overdose of Pentothal sodium

5. Grim, J. E., and Knight, R. T., An Improved Intratracheal Technic. *Anesthesiology* 4:6 (January) 1943.
6. Elliott, H. L., and Arrowood, J. G., Anesthesia for Oral Surgery in the Presence of Cautery and Diathermy. *Anesthesiology* 6:32 (January) 1945.
7. Burstein, C. L., and Rovenstine, E. A., Respiratory Parasympathetic Action of Some Shorter Acting Barbituric Acid Derivatives. *J. Pharmacol. & Exper. Therap.* 63:42 (May) 1938.

and resume his normal respiratory rhythm. Usually events move so rapidly that analeptics are unnecessary. Carbon dioxide should not be given to these patients unless there is reason to believe that it has been washed out by artificial respiration, and then in no greater concentration than 5 per cent.[8]

Choice of Anesthetic

The choice of agent and method of its administration are influenced to a large degree by the operation which is planned. Probably the most difficult problems are those presented by patients having fractures of the jaw, and by those cases involving excision of tumors.

In cases of fractured jaw the choice and technic of administration of the anesthetic is largely dependent upon the type of fixation which is to be employed. If local anesthesia can be used it is by far the safest in these cases. If, however, a general anesthetic is chosen, endotracheal intubation should be accomplished if possible. Usually oral intubation, although safer from the anesthetist's standpoint, is impractical because (1) there is some danger of further traumatizing the fracture in the course of direct laryngoscopy, and (2) the tube is likely to be in the way of the surgeon and may interfere with the proper positioning of the patient's jaws. It is usually possible to accomplish blind nasal intubation and avoid these difficulties. During the period of emergence from anesthesia, before the patient is sufficiently conscious to protect himself, two dangers are paramount. The first is respiratory obstruction by the tongue or from relaxation of the muscles of the jaws, and the second is nausea and emesia with aspiration of vomitus. To protect against these dangers the following precautions are recommended:

1. The endotracheal tube should be left in place until the patient is sufficiently conscious to cooperate.

2. Operation should be performed on the fasting patient whose stomach is certainly empty.

3. If the jaws are to be fixed together, the use of elastic rather than wire is advised for this purpose.

4. A Levin tube may be passed through the nose to the stomach before operation and left in place, so that the stomach can be aspirated at frequent intervals and thus kept empty.

If diathermy is to be used in the course of the operation, as in cases of malignancy, it automatically rules out the use of any of the inflammable agents such as ether, Vinethene, cyclopropane and ethylene. Chloroform, although often mentioned in this connection because it is noninflammable, should not be used because of its low margin of safety. The best choice is Pentothal sodium supplemented by nitrous oxide and oxygen.

Consideration of certain specific diseases is of considerable importance in the choice of anesthesia.

Respiratory Diseases

Elective operations should not be performed in the presence of acute respiratory infection.

Occasionally emergencies arise in the cases of patients who have respiratory infection, and operation is imperative. In this event, local or regional anesthesia should be used if it is possible. If not, Pentothal sodium supplemented by nitrous

8. Beecher, H. K., and Mayer, C. A., Mechanisms of Respiratory Failure under Barbiturate Anesthesia. *J. Clin. Investigation.* 5:549 (September) 1941.

oxide and oxygen is probably the least irritating combination of agents. Nasal intubation is inadvisable in the presence of infection of the upper respiratory tract. Direct oral intubation should be accomplished if the indication for intubation outweighs the likelihood of laryngitis or tracheitis.

In chronic pulmonary disease, such as bronchiectasis or pulmonary tuberculosis, with consequent decreased vital capacity, the paramount consideration is an abundance of oxygen. The oxygen concentration in the inhaled mixture should not be less than 20 per cent at any time. If nitrous oxide is used it should be supplemented with a more potent agent if good relaxation is not obtainable with an adequate oxygen concentration. Cyclopropane is nonirritating and is a good choice for patients with chronic pulmonary disease. Patients with suppurative pulmonary disease are not good risks for Pentothal sodium anesthesia.

Cardiovascular Disorders

Often patients with fractures about the face and jaws arrive at the hospital in a state of peripheral-vascular collapse. Although it is of course desirable to care for the fracture promptly, surgical treatment should not be begun until the patient has been treated effectively for shock. The possibility of injury to the brain should be considered, and if there is any indication that this may have occurred it should be ruled out in consultation with a neurosurgeon before surgical treatment is begun. Any procedure for effecting anesthesia which might increase edema and swelling of the brain must be avoided if there is any suspicion of cerebral injury.

A fairly large proportion of patients have high blood pressure, caused by either essential hypertension or generalized arteriosclerosis. In these patients, there is danger that excitement or anoxia may cause a sudden extreme rise in blood pressure and result in a cerebrovascular accident. Excitement or reduction in the oxygen supply to the heart may precipitate an anginal attack or coronary occlusion. Therefore, excitement and a prolonged period of induction must be avoided, and high concentrations of oxygen must be offered at all times.

Well compensated patients with valvular heart disease tolerate anesthesia as well as normal persons, provided that the anesthetic is well administered and the oxygen suppy adequate. Accidents are most likely to occur in patients with coronary or hypertensive heart disease with myocardial damage. They are the ones most subject to acute failure resulting from overexertion and lack of oxygen. Cyclopropane is not a good choice for these patients. Ether is usually selected if a potent agent is needed and is well tolerated. Patients with congestive heart failure or with acute coronary occlusion should not be operated on except in extreme emergencies.

Miscellaneous Diseases

Patients with marked impairment of the kidneys are poor risks for anesthesia and operation. Even for minor surgical procedures, they should be hospitalized and under close medical supervision. Nitrous oxide and ethylene have no deleterious effect on the kidneys if the oxygen supply is adequate. Robbins[9] stated that the kidneys show less disturbance after administration of cyclopropane than after ether. Kidney function is depressed after ether or Pentothal sodium anesthesia and returns to normal within twenty-four to forty-eight hours. Pentothal sodium should not be chosen in a case of severe kidney disease.

The liver is not affected by nitrous oxide and ethylene if they are administered

9. Robbins, B. H., *Cyclopropane Anesthesia.* Baltimore: Williams & Wilkins Co., 1940.

with sufficient oxygen. Cyclopropane produces no damage to the liver detectable by the bromsulfalein test. There is some disagreement as to the effect of Pentothal sodium on the liver, but I should hesitate to give it to a patient with any marked degree of disease of the liver. The use of tribromoethanol is contraindicated in hepatic disease.

Metabolic Disorders

Only operations of some urgency should be carried out on thyrotoxic patients. On account of the patient's high metabolic rate a generous supply of oxygen must be available if inhalation anesthesia is used. Cyclopropane is not a good choice for a patient with thyrotoxic heart disease. The use of Pentothal sodium is not advisable for thyrotoxic patients, and tribromoethanol is contraindicated.

Elective surgery should not be undertaken on the patient with uncontrolled diabetes. If emergency operation is imperative, under these conditions, a local anesthetic or one of the gases, nitrous oxide, ethylene or cyclopropane, should be chosen. For patients in whom the carbohydrate metabolism has been brought under control practically any type of anesthetic can be used if the general principles for its use are scrupulously observed.

Patients with bronchial asthma must be handled with extreme care. They do not tolerate well any more than analgetic concentration of nitrous oxide. Gases should not be administered under pressure to patients with asthma; sometimes they will not tolerate even the added resistance of the machine with gases at atmospheric pressure, but will react well to completely open administration. Cyclopropane does not depress the vagus nerve and does not relax the bronchioles. Ether is well tolerated. It relaxes the bronchioles even during severe asthmatic attacks, and long remission of symptoms in asthma has been reported after administration of ether. It is probably the best choice for oral operations on patients with asthma.

Blood Disease

Since patients with a low red blood count are unable to tolerate lack of oxygen in any degree, only those agents which can be offered with a high concentration of oxygen should be administered to them. In severe anemia the patient's color is not a reliable guide as to the adequacy of the oxygen supply, because the oxygen content of the blood may reach asphyxial levels before the amount of reduced hemoglobin is sufficient to cause perceptible cyanosis.

Even minor operations on patients with bleeding tendencies, such as those encountered in hemophilia or familial jaundice, should be performed in the hospital. The anesthetist should be informed of the condition so that he may exercise particular care to protect the patient's lips and mucous membranes from trauma during his manipulation. Nasal intubation should not be employed.

Postoperative Complications

Occasionally the patient suffers shock resulting from extensive oral surgical procedures on bone, or from loss of blood. The patient should be treated in the orthodox manner. He should not be moved while in shock, and the foot of the bed should be elevated. Fluids, preferably plasma or blood, should be given intravenously. Pressor drugs such as ephedrine and Neo-Synephrine hydrochloride are contraindicated.

Sometimes, especially after anesthesia induced with intravenous administration

of barbiturates, the patient's postoperative sleep is unduly long. Careful nursing during this period is of great importance. The patient should be watched carefully to guard against respiratory obstruction or aspiration of blood or saliva into the lower respiratory tract. Change of position at least once every hour is important in the prevention of pulmonary complications. Fluids should be given intravenously to combat dehydration. Oxygen administered through a nasal catheter is indicated for the prevention of anoxia. Analeptics are usually unnecessary and should be used only after recovery has progressed to the point where the patient's reflexes are active. In our experience, Benzedrine sulfate has been the most effective analeptic and is particularly useful if the patient is restless and uncooperative.

Collapse or failure of aeration of areas of a patient's lung or even of an entire lobe is not of infrequent occurrence after anesthesia and operation. It is most frequently caused by the obstruction of a bronchus by a plug of mucus. In order to prevent such an occurrence the period of deep anesthesia should be kept as short as possible, and every effort should be made to have the patient recover consciousness and begin to move about in bed as soon as possible. Until this occurs he should be turned from side to side once every hour. When diagnosis of atelectasis is made the patient should be encouraged to cough in an effort to dislodge the bronchial plug. If this is unsuccessful, the plug should be removed by either suction applied through a bronchoscope or by a method employed at the Wisconsin General Hospital, in which a nasal endotracheal tube is first introduced and a suction catheter is then passed through it to remove the mucus.

Probably the worst complication after operation on the mouth and pharynx is abscess of the lung. The danger of the entrance of blood and infective material into the lower respiratory tract is always present. In the earlier part of this paper several suggestions were made as to the prevention of this accident during anesthesia and operation. To prevent it during the postoperative period the patient should be watched very carefully. He should be kept on his side in such a position as to promote drainage, and the mouth and pharynx should be cleared by suction when necessary. The foot of the bed should be kept elevated until the patient is conscious.

Summary

Some problems of anesthesia for oral surgical operations are reviewed, and suggestions are made for the management of anesthesia for this type of work.—*750 Harrison Avenue.*

EXHALATION DEFLECTOR

Reed P. Rose, D.D.S., B.S.,*
and Edward E. Black,† D.D.S.,
Pittsburgh

The exhalation deflector is a device designed to deflect exhaled gases escaping from the exhaling valve on the nasal inhaler or nasal hood, in such manner as to divert them to avoid rebreathing of them by the operator and the anesthetist.

Rebreathing by the operator and the anesthetist occurs frequently during the administration of the gaseous and volatile (vaporized) anesthetic agents. This constitutes an annoyance and is undesirable from the standpoint of physical well-being. Daily repeated rebreathing of these exhaled gases will exert an immediate untoward influence and may ultimately induce injurious side effects. There is also a hygienic factor involved, in that the patient may be tuberculous or may communicate an upper respiratory infection. The undesirability of all of these factors justifies the development of some means for their elimination.

This rebreathing is an unavoidable circumstance induced by positional requirements in cases in which the oral surgeon is performing extraction of certain teeth and other oral surgical procedures. If the operation is performed without such a device it may often be necessary for the anesthetist to cup a hand over the exhaling valve to protect himself or the surgeon. This places an additional burden on the anesthetist and impairs his efficiency because it limits the use of the free hand. Since

Fig. 1.—Left: View of exhalation deflector prior to positioning or after removal. Right: Deflector in position on exhaling valve, showing self retention

*Oral surgical section, dental staff, Presbyterian and Woman's Hospitals, Pittsburgh. Former instructor, department of anesthesia and oral surgery, School of Dentistry, University of Pittsburgh.
†Department of anesthesia, Elizabeth Steele Magee Hospital, Pittsburgh. Member of the American Society of Anesthesiologists.

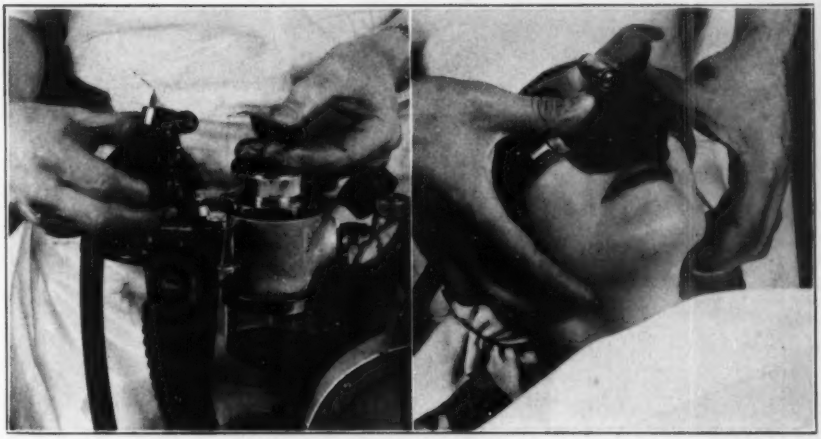

Fig. 2.—Left: Two types of exhalation deflectors which show how angle of deflection may be altered. Right: Deflector in use to protect members of operating team

one hand must necessarily be used constantly for the maintenance in position of the nasal inhaler and the patient's head, to insure patency of the airway, it may be referred to as the fixed hand. The other, or free hand, should be kept so in order to permit freedom for regulation of gaseous pressures and percentages, taking of pulse and blood pressure readings and the multitude of other duties which are required of the anesthetist.

Description

The exhalation deflector consists of a single unit constructed of metallic, plastic, resinous or other material suitable for its purpose. It is so designed that it may be placed in position on the exhaling valve prior to or during administration of the anesthetic and may be removed at any time (Fig. 1). The design permits quick and easy positioning and removal. The deflector is cut out to permit access for manipulation of the pressure adjustment on the exhaling valve and does not interfere with its action or use (Fig. 2, left). Finger access to the exhaling valve is permitted, without removal of the deflector, if the anesthetist wishes to hold the valve closed. When the deflector is in position no appreciable back pressure seems to be created within the nasal hood or the anesthetic administration system.

Summary

The advantages accruing from the use of such an attachment may be summarized as follows:

1. Exhaled gases are deflected and direct rebreathing by members of the operating team is eliminated.
2. Undesirable physiologic effects subsequent to rebreathing of exhaled gases are eliminated.
3. An annoyance which detracts from the operator's and the anesthetist's efficiency is avoided.
4. Character of the respiratory sounds is enhanced. (This is of distinct value in the operating room if a suction machine, dental engine, electrically driven surgical mallet, ventilating fan or air conditioner is concurrently in use.)

5. Efficiency of the anesthetist is increased by elimination of the task of manually deflecting exhaled gases. The attachment is a more effective deflector than the cupped hand of the anesthetist.

6. The attachment is quickly and easily positioned or removed at any time and is self-retaining when in position (Fig. 1, right).

7. The deflector may be of value from the hygienic standpoint (Fig. 2, right).

Comment

It is believed that the necessity for such an attachment on the exhaling valve has existed for some time. Since the introduction of such vaporized anesthetic agents as divinyl ether for office use, this necessity has become intensified. The exhalation deflector is proposed for the purpose of satisfying this need.—*5030 Jenkins Arcade.*

NATIONAL BLOOD PROGRAM

The American Red Cross has announced the new National Blood Program, an undertaking designed to provide sufficient whole blood and blood derivatives for medical use throughout the entire nation without charge for the products.

The new peacetime project has been approved in principle by the major health organizations of the country. The various phases of the program, which will conform to standards set by leading authorities, consist of (1) collection of blood, (2) its processing for use as whole blood and blood derivatives, including packing and storage, (3) distribution of the blood and blood products for use by physicians and hospitals for any patients needing them and (4) continuous investigation of the quality of the products, their safety and important uses. It is estimated that the program, which will be financed by the Red Cross, will be in full operation in three to five years.

In addition to whole blood and plasma, the program will provide other blood derivatives of proved value, such as (1) serum albumin, (2) immune serum globulin, (3) antihemophilic globulin, (4) blood grouping serum, (5) fibrin films and thrombin, (6) red cell suspensions and (7) red cell paste and powder.

The Red Cross National Blood Program needs the continuing support and active cooperation of all the American people.

TECHNICS IN THE CONTROL OF OPERATIVE AND POSTOPERATIVE HEMORRHAGE

Joseph W. Ewing, M.D., D.D.S.,
Akron, Ohio

Very little material has appeared in the literature regarding the problem of operative and postoperative hemorrhage. The material available is mostly of a statistical nature, and I found nothing of recent edition regarding hemorrhage connected with oral surgery.

This subject must be considered from a pathologic aspect as well as anatomically and mechanically. A brief list of the pathologic conditions in which hemorrhage is an important factor would include the various types of anemia, the most important probably being (1) pernicious anemia; (2) anemia of pregnancy; (3) hemolytic anemia; (4) aplastic anemia, and (5) sickle cell anemia. The list would also include agranulocytosis resulting from various causes including prolonged administration of sulfonamide drugs; infectious mononucleosis; diseases of the lymphatic system including leukemia; Hodgkin's disease, and multiple myeloma, as well as hemorrhagic disorders and anomalies in blood coagulation time which would embrace purpura; hemophilia, and vitamin K deficiency.

If any of these conditions is associated with a surgical procedure it should be investigated thoroughly and placed under control, if possible, before the procedure is instituted. The disease generally can be corrected to a point where the risk of hemorrhage during operation is not so great.

In the control of hemorrhage during an operative procedure caution and conservation of tissue are the primary considerations. A local anesthetic containing varying amounts of epinephrine, if used alone or as a hemostatic agent in conjunction with a general anesthetic, is a great aid in controlling operative hemorrhage.

Whether one is operating on soft tissue in which each bleeding point may be cared for as encountered, or whether one is performing an intra-oral operation in which both bone and soft tissue are to be contended with, it is of utmost importance that the tissue be handled with the greatest possible care. Tissue should be severed from its attachment by sharp dissection. Blunt dissection may be used when tissues are being separated but only to a point at which the tissue is not likely to be torn. For example, during multiple extraction of teeth the interdental papillary attachments, if adherent, should be dissected free by means of a sharp instrument. The mucous membrane can then be retracted from the bone by means of a periosteal elevator or some similar instrument. The teeth should then be removed with as little trauma to the surrounding bony structures as possible. The bulging cortical plate is then removed, any loose pieces of bone should be removed and all sharp bony spicules should be smoothed by means of rongeurs and files. Exposed bone should be inspected carefully and any small rough areas should be burnished. The mucous membrane is then folded carefully back over the operative site. If this procedure is carried out in the prescribed manner, it has been my experience that it is rarely necessary to suture the two edges of mucous membrane. In fact, the placing of sutures is necessary in less than 15 per cent of cases. In the small percentage of cases in which I do place sutures, one or more of the previously mentioned pathologic conditions may be pre-existent and difficult to control. I have found that the lips and tongue act as an

Read at the twenty-ninth annual meeting of the American Society of Oral Surgeons, Boston, July 31, 1947.

adequate bandage for tissue approximation until initial healing has taken place. Return to the office or an emergency room in some hospital to control bleeding of a patient is rarely necessary.

Ligation

In general surgical procedures it is often necessary to ligate major vessels before attempting certain types of operations. This is seldom true in the practice of oral surgery and its associated fields. We can control bleeding to a certain extent by ligation of some of the major vessels. I have on one occasion ligated both right and left branches of the lingual artery as it comes off the external carotid artery, in order to control hemorrhage in a patient with carcinoma of the tongue. Nevertheless, collateral circulation was sufficient to cause seepage for some time until it was finally controlled by means of a hemostatic agent which I will describe later.

I once assisted in the management of a patient who had a pulsating tumor in the upper left third molar region. This patient on three previous occasions had had surgical procedures carried out on the left side of his face. Each time he had bled so profusely that hospitalization and multiple transfusions were necessary to control the hemorrhage. Two of the hemorrhages occurred after extraction of teeth, and the third occurred after a Caldwell-Luc operation on the patient's left antrum.

We discussed the patient thoroughly before deciding to remove the tumor which was, without question, an aneurysm of the internal maxillary artery. Therefore, before any surgical treatment of the tumor was attempted an incision was made in the patient's neck and the common carotid artery was identified at the point of its division into the internal and external carotid arteries. The external carotid artery was ligated, and a section about 1 cm. in length was removed from it. After ligation of the external carotid artery the pulsation of the tumor ceased and it was felt to be quite safe to excise it because the pressure had been removed. However, when excision was attempted, a copious flow of blood was encountered which was so great that mechanical suction could barely keep the field clear. The hemorrhage was stopped by means of digital pressure applied by an intern. We reopened the wound in the neck and placed a ligature around the common carotid artery, thinking that perhaps blood was coming from above through the internal carotid artery by collateral circulation. When the pressure was removed the bleeding resumed with the same vigor previously encountered, despite temporary ligation of the common carotid artery. The ligature was then removed from the common carotid artery and the wound in the neck was closed again. After much difficulty the tumor was finally excised, and two bundles of fibrin foam soaked in thrombin were placed immediately in the base of the cavity. A pack was placed over the fibrin foam and sutured tightly in position. This pack was removed at intervals after being permitted to remain in place for five days, and no further hemorrhage was encountered on its complete removal. On later investigation of material on the subject in the literature and textbooks, I found a statement that the internal maxillary artery alone has twenty-six separate points of collateral circulation.

I cite this case in order to verify my earlier statement that ligation of major vessels during oral surgical operations is of relatively little value.

Infection

Infection must be kept in mind at all times if postoperative hemorrhage is to be carefully controlled. Many years ago a man came to me with massive cellulitis of the face and neck. He was sent to a hospital where the infected region was incised and

supposedly drained. Several days later, according to hospital personnel, the patient suddenly sat up in bed, blood gushed from his mouth with great force and before anything could be done for him he was dead. Autopsy could not be performed, but unquestionably the abscess had eroded into one of the major vessels of the neck with its subsequent rupture and death of the patient.

Recently a leading eye, ear, nose and throat specialist performed tonsillectomy on an 18 year old girl under local anesthesia in his office. She returned to her home and was apparently doing well when an infection developed in the right peritonsillar region. She was sent to the hospital and given chemotherapy for a period of five days, after which she again returned to her home. Two days later she suddenly began bleeding profusely from the right tonsillar fossa and was returned to the hospital. Transfusions were administered immediately and bleeding was controlled by means of a pack. For about eighteen hours the bleeding seemed to be well under control, according to one of the residents who said that he had talked to the patient at about 7 p.m. At 8:30 p.m. the patient suddenly sat up in bed with blood gushing from her mouth, and in a few minutes she was dead. Undoubtedly the infection had eroded the posterior wall of the tonsillar fossa and had invaded possibly the internal maxillary artery which is quite large at this point, just posterior to the tonsillar fossa.

Vincent's infection must always be considered in connection with postoperative hemorrhage in oral operations. Seemingly normal mouths may bleed profusely and persistently after extraction of teeth. Frequently investigation shows an active case of Vincent's infection to be the cause. This is a rather serious situation as it may be necessary to treat numerous dry sockets which have resulted from zealous attempts to control the infection in order to control the hemorrhage. In the actual control of a bleeding area ligatures and the application of hemostats are often of no avail because of inaccessibility of the severed vessel.

Hemostasis

Adrenalin Chloride (epinephrine hydrochloride) by topical application is an old standby, but its action as a peripheral vasoconstrictor is of such short duration that results are discouraging in the presence of severe oral bleeding. The application of fresh muscle tissue has been effective because of its adherence to the bleeding surface and the potential release of thrombin. However, this procedure has not been too practical, because the moist pledget can be moved easily from the site of hemorrhage during packing of a wound.

Fibrin foam was hailed with enthusiasm as a satisfactory coagulant with minimal tissue reaction. However, the material is difficult to procure and expensive. Fibrin foam must be placed directly on the bleeding point or hemorrhage cannot be controlled.

The next material to be produced for this use was Gelfoam (Upjohn), a spongy substance of partially denatured gelatin. It was found to control bleeding by its prolonged absorptive action which was found to be increased when the Gelfoam was dipped in bovine thrombin. Its advantages have been its adherence to the bleeding surfaces and lack of tissue reaction. This substance, too, must be placed directly on the bleeding point in order to be effective.

The third hemostatic agent, and in my experience by far the most successful as well as the least expensive, is a substance known as Oxycel (Parke, Davis) which consists of a fine meshwork, resembling a gauze bandage, of oxidized cellulose. This is the only one of the three agents described which does not have to be placed di-

rectly on the bleeding point. I have been called to see patients who were bleeding vigorously at all points after multiple extractions or extraction of the teeth of an entire arch. Although none of these hemostatic agents will control arterial bleeding, I have yet to see hemorrhage that could not be controlled by the action of a strip of Oxycel laid over the bleeding area, after any adherent clots were carefully wiped away, and maintained in position by firm pressure for about ten minutes. This substance has been placed and left in deep wounds, such as those resulting from removal of a condylar head, with no postoperative difficulties. This is a recommendation of the highest merit, as anyone who has ever cut into a branch of the pterygoid plexus during condylectomy can realize the extensive hemorrhage that results. Oxycel may be placed in a tooth socket and allowed to remain there without any untoward effects after extraction associated with severe hemorrhage. It may be placed in the wound after removal of a deeply impacted third molar and allowed to remain to act as a network for the formation of the ensuing clot.

Another interesting feature of oxidized cellulose is that it can be peeled away from the raw surface of a bleeding wound at the end of three days without any evidence of adherence of the gauze to the raw surface and thus without causing any further bleeding. However, as I previously stated, the substance is rarely removed after its use in oral surgical practice but is allowed to remain in position and permitted to become an active part of the organization process of healing. Any of these hemostatic agents may be sutured in position, Oxycel most easily of all as it has more body than the others.

One may augment this treatment by injection of a local anesthetic agent around the bleeding area. If the combined treatment is not effective it is assumed that one is not dealing with a normal patient, and a hematologist should be consulted at once.

Summary

1. Any pathologic condition of the patient, as suggested by his history, should receive attention prior to operation.

2. A local anesthetic containing epinephrine is an aid in hemostasis.

3. Tissue should be handled carefully in the interests of conservation.

4. Ligation of major blood vessels is of relatively little value in oral surgical procedures.

5. The role of infection in postoperative hemorrhage should be kept in mind.

6. The use of topical hemostatic agents is recommended. Of these, epinephrine is fairly effective but has a fleeting action. Fresh muscle will release thrombin for a short period but is readily dislodged from the bleeding site. Fibrin foam causes no tissue reaction but is expensive, difficult to handle and must be placed on the bleeding site. Gelfoam may be compared with fibrin foam except that it is less expensive. Oxycel has all the merits of fibrin foam and Gelfoam and is the least expensive.
—710 Akron Savings and Loan Building.

RESPONSIBILITY OF THE ORAL SURGEON IN RECOGNITION OF SYSTEMIC DISEASE BY ORAL SYMPTOMS

Thomas J. Cook, D.D.S.,
Miami, Fla.

Less than thirty years ago, when the American Society of Oral Surgeons was founded, comparatively little, aside from the stereotyped conditions that were found in the textbooks, was being taught in our dental schools to aid the practitioner in the diagnosis and treatment of intra-oral disease, and especially in the recognition of the oral manifestations of systemic disease.

Although it is not a policy of oral surgery to attempt diagnosis of a systemic disease on oral manifestations alone, the recognition of such lesions warrants further investigation. It is true that many times our suspicions will prove to be unfounded, but when they are confirmed our efforts are well repaid, for early diagnosis of any disease and the institution of early treatment leads to a more favorable prognosis; and after all it is our responsibility.

Responsibility for Diagnosis

The cardinal principle of the successful treatment of disease is an accurate knowledge of the cause and nature of the particular disease on the part of the one who undertakes to treat it, and the practitioner of any phase of the healing art is definitely obligated morally and legally to exert every effort in the application of all the knowledge gained in his professional education and later experience to arrive at a correct diagnosis of any and every ill that he undertakes to cure.[1]

In considering the legal status of the oral surgeon, attention is directed to his legal status as a dentist rather than as a specialist in the field of oral diagnosis and surgery. Only in rare instances does the law treat with the oral surgeon as a specialist. Even then, it does not establish any special rules applying only to oral surgeons but adopts the rules which are applicable to all specialists in the healing arts. Generally speaking, the same principles of law govern the oral surgeon and other specialists as govern the general practitioner. Exceptions are made only in those cases in which they are proper, because the public has the right to expect a greater degree of skill or knowledge from a specialist if the particular question involved falls within the scope of his specialty.

The moral obligation is embodied in the mental processes that have led to the desire to pursue a humane calling.[1]

Almost twenty years ago, Prinz[2] stated:

The diseases which attack the organs contained within the oral cavity are by common consent divided into those which are restricted to the teeth and their adnexa and those which involve the bones and the soft tissues, including the tongue. . . . The preponderance of surgical diseases, by reason of the economic law of supply and demand, has created within the last half century a new specialist, the oral surgeon. The remarkable achievements accomplished by

Read at the twenty-ninth annual meeting of the American Society of Oral Surgeons, Boston, July 31, 1947.

1. Anthony, L. Pierce, Responsibility for Diagnosis. *J.A.D.A.* 26:1877 (November) 1939.

2. Prinz, Hermann, Common Diseases of the Oral Mucous Membrane and the Tongue. *Dental Roster* 4:6 (November) 1930.

the oral surgeon within this period are ample proof of the need of this specialist, and at this moment he has firmly established himself within the community as a necessary adjunct to the complicated system of the healing art.

Adequate diagnosis of oral diseases and disorders involves a thorough knowledge of normal and abnormal conditions, including particularly the ability to detect and interpret the signs and symptoms of disease.

The mucous membranes of the oral cavity may manifest the Koplik's spots of measles, the early or late lesions of syphilis, the signs and symptoms of vitamin deficiencies, the oral manifestations of blood dyscrasias, and so forth. Although it is true that the oral surgeon, more than any of the other specialists, is apt to have such cases referred to him for diagnosis, they are referred to him by both the physician and dentist. There is a tendency on the part of the physician to refrain from the practice of oral diagnosis as the dentist becomes more competent in this particular field. The responsibility, as I see it, falls on the shoulders of the oral surgeon. He has written in medical and dental periodicals of the various diseases that are manifested in the oral cavity, and two textbooks that have had a tremendous following have been written by oral surgeons, Mead[3] and Thoma.[4]

Diagnosis of Pain About the Face

Craig[5] pointed out:

The complaint of pain about the face and head is encountered so frequently that a consideration of the underlying cause, differential diagnosis and treatment are always of interest and importance. Many types of lesions, involving not only the cranial nerves but also the structures of the mouth and nasopharynx and the superficial structures, may be the underlying causes of pain. All pain in this region usually is referred to as "neuralgia," and for that reason it is important to distinguish between true neuralgia and atypical neuralgia of the face, head and neck.

Rowe[6] stated:

It is generally believed, and quite correctly, that most pain in the region of the face has its origin in defects of the teeth. As a result, most persons with such a symptom first consult their dentist. Sometimes, however, careful clinical and roentgen-ray study fails to reveal any pathologic dental condition, nor does repair of defective teeth stop the patient's discomfort. What, then, are the other possible causes of facial pain? What treatment is available?

To whom can the dental practitioner turn? Who will accept the responsibility for diagnosis of this undetermined pain? My answer is that the oral surgeon, because of his training in diagnosis, his hospital associations and his general background, should accept this responsibility.

Craig pointed out that the only three true neuralgias are trigeminal, glossopharyngeal and occipital.

Glaser[7] stated that from a clinical standpoint atypical neuralgia has many things in common with true migraine, but that, in addition, it has some points in common with neuralgias of the cranial nerves, particularly with trigeminal neuralgia. He further stated that operations on the trigeminal tract, extraction of teeth, and so forth, carried out indiscriminately in poorly chosen cases will do far more harm than good and leave the patient in a much worse condition than before operation.

3. Mead, S. V., *Oral Surgery*. St. Louis: C. V. Mosby Co., 1946.
4. Thoma, K. H., *Oral Pathology*. St. Louis: C. V. Mosby Co., 1944.
5. Craig, W. McK., Diagnosis and Treatment of Pain About the Face and Head Comprising Major Types of Neuralgia. *J.M.A. Alabama* 6:296 (March) 1937.
6. Rowe, S. N., Diagnosis and Treatment of Facial Pain of Non-Dental Origin. *J.A.D.A.* 24:1635 (October) 1937.
7. Glaser, M. A., Atypical Neuralgia. *Arch. Int. Med.* 65:340 (February) 1940.

Neurosurgeons in their writings have warned of the removal of teeth or operation on the jaws for the relief of incorrectly diagnosed pain.

If we are to accept the responsibility of diagnosis, our patients' histories must be carefully taken, our roentgenograms interpreted correctly and our clinical examination completed before we refer the patient to the neurologist or neurosurgeon.

Responsibility in Surgery

In this phase of my discussion I will confine my remarks to experiences encountered during a four year period in the United States Army.

In 1941, Carr,[8] in a committee report to the American College of Dentists, wrote: "At the present time, when mobilization is being considered as a vital part of national defense, it is already recognized that the Army and Navy shall not only require but are anxious to know of men who are particularly trained in any of the specialized fields, and of these, oral surgery seems to be the most important."

Designation as Oral Surgeon

According to the Dental Division, Office of the Surgeon General, the requirements for Master Occupational Specialty rating in oral surgery specified that one "should be thoroughly familiar with all laboratory procedures involved in the care of oral surgery patients. . . . Should have background of extensive experience in oral surgery and have been a member of a hospital staff. An internship, fellowship or residency in a recognized hospital or other institution is desirable. . . ."[9]

During the war there were approximately sixty Army Dental Corps officers listed with Master Occupational Specialty rating in oral surgery.

Responsibility Offered the Oral Surgeon

It is my personal opinion that the oral surgeon was offered responsibility. During the war I was associated with a general hospital where it was necessary to formulate a plan of treatment before the beginning of a certain campaign. In cooperation with the general surgeon a program was set up which functioned most satisfactorily during the months which followed.

As the oral surgeon, I assumed responsibility for the patients with wounds involving the jaw bones and supporting structures. We saw the patients on admission, removed the dressing and examined the wounds. We wrote the history and the orders.

When immediate treatment was required we worked at the operating table with or without the general surgeon and assumed responsibility for the postoperative care of the patient. If the patient was ambulatory he was seen daily in the oral surgery section, which was set up apart from the dental clinic; if he was bed-ridden he was seen daily during rounds of the ward.

Seminars

Shortly after the arrival of our first maxillofacial cases monthly meetings of all dental officers in the area were established by the base dental surgeon. The cases in the hospital were presented, treatment was discussed, and a program was set up for the early and late care of maxillofacial cases. The program, which we felt the oral surgeon should be capable of participating in, was as follows:

8. Carr, Malcolm W., Oral Surgery. *Am. Coll. Dentists* 8:11 (March) 1941.
9. Personal communication.

Early and Definitive Treatment at Portable Surgical Hospital

Treat shock, if possible.

Arrest hemorrhage. Moderate hemorrhage usually can be checked by insertion of a gauze pack into the wound and application of pressure by a four-tailed bandage. Hemorrhage that cannot be checked in this way demands a search for the bleeding vessel and application to it of a clamp. The vessel is tied off, if ligature material is not available, and the clamp is left on during transportation of the patient.

Provide for an adequate respiratory airway. If there is loss of control of the tongue there may be danger to respiration. This danger is best controlled by exertion of traction on the tongue by means of a long suture passed through the tip of the tongue. The tongue can be drawn forward and the suture attached to the dressing. These considerations are particularly important if the patient is unconscious.

Tracheotomy should be considered as a last resort.

Débridement as understood concerning wounds of other parts of the body is not carried out so extensively on wounds of the face. Shreds of obviously devitalized tissues are cut away, but displaced flaps of tissue may be sutured back into approximate position. Edges of skin and mucous membrane in large wounds communicating with the mouth should be sutured together so as not to leave raw surfaces and exposed bone. Great care should be taken to avoid injuring branches of the seventh nerve and the salivary duct.

Do not remove fragments of bone which have any attachment to soft tissue.

Sulfonamide compound should be administered locally (dusted on lightly) and by mouth. Penicillin should be administered when indicated.

A complete record of treatment should accompany the patient, that is, drugs used, foreign body removed, and so forth.

Patients with injuries of the jaw are placed in one of the following positions on a litter: on the side, with head on the side; or prone, with head on the side, or prone with face down and head supported on a sling.

Definitive Treatment at Fixed Hospital

Every possible facility in the way of equipment and special personnel for proper care of the patients under consideration is provided for in the general hospitals. The definitive treatment can be grouped under the following headings:

1. Complete record of history to date.

2. General medical and physical survey of all injuries and conditions of disease that may be present, especially acute respiratory diseases and other infections.

3. Laboratory procedures, such as examination of blood and urine, bacteriologic cultures and other measures.

4. Special maxillofacial survey, this examination to be conducted jointly by the general surgeon and the oral surgeon and to consist of (a) complete clinical examination of the region involved in the injury; (b) roentgenographic examination of the bones of the face and jaw (intra-oral, stereoscopic, roentgenoscopic, and so forth), as indicated; (c) record of findings, and (d) photograph.

5. The foregoing survey will reveal (a) structures involved in the injury of soft tissue (skin and subcutaneous tissues, facial nerve, salivary glands and ducts, floor of mouth, tongue, soft palate, neck and other tissues); (b) inflammatory conditions of the soft tissues (cellulitis, abscess, hematoma, and so forth); (c) presence of foreign bodies; (d) injuries to the teeth; (e) location and extent of fractures of the bones

of the jaw and neighboring bones (orbits, paranasal sinuses, nasal fossae, and so forth), and (f) infection of bone.

Fractures of Jaws

1. Treat all fractures as emergencies.
2. The general treatment of the patient has preference.
3. The simplest form of reduction should be used.
4. Have the patient report daily to oral surgery when possible.
5. Keep careful records.
6. Administer sulfonamide compound routinely and penicillin when indicated.

Mandibular fractures are more common than fractures of the maxilla and may be simple, multiple, compound and complicated with other injuries, or in combination with fractures of the maxilla, face and head.

Treatment: (a) Intermaxillary ligation is the treatment of choice in simple fractures, and (b) treatment of complicated fractures depends on the nature of the fracture. Fragments of bone with tissue attachments should not be removed.

Fractures of the maxilla are frequently associated with serious injury of the bones of the head and face.

Treatment: (a) Simple fractures may be handled with intermaxillary ligation, and (b) extra-oral traction may be necessary in complicated fractures.

Fractured bones of jaws which have not been reduced perfectly and fixed may unite in the position assumed by the fragments after the injury.

Treatment: It may be possible to reduce the fragments to the normal position by gradual elastic traction, if the patient is seen before consolidation is complete.

The primary object of treatment is the restoration of function. To accomplish this, the former occlusal relation of the remaining teeth should be approximated.

Acceptance of Responsibility by the Oral Surgeon

It is my personal feeling that the oral surgeon accepted his responsibility.

In an assignment to a general hospital in this country, toward the end of the war, where several hundred patients with injuries of the face and jaw bones were under treatment, I had access to the records and saw patients from every theater of war. The names of the oral surgeons who treated the patients became thoroughly familiar to me. Their records were good and there was nothing but praise from the patients.

It has been said that the difference between fractures of the jaws in times of war or peace is that most of the former fractures are comminuted and complicated by serious wounds of the soft tissues. Consequently, the war wounds are more subject to prolonged infection, with the formation of sequestrums and slower healing. In times of peace the severe crushing injuries caused by automobile accidents most nearly approach those occurring in warfare.

Fairbank and Ivy[10] stated:

> Experience in the care of injuries of the face and jaws occurring in the war of 1914 to 1918 has brought out certain fundamental principles which should be observed if the best results are to be obtained in treatment. The soundness of these principles has been adequately demonstrated in the succeeding years with a very large number of comparable cases in peacetime. After the return to hospitals in this country in 1919 of cases of maxillofacial injury, it was generally possible to determine which of them had received treatment governed by these

10. Fairbank, L. C., and Ivy, R. H., Emergency Treatment and Primary Apparatus for Fractures of Jaws in Warfare. *Mil. Surgeon* 88:124 (February) 1940.

principles from the beginning, and which, on account of military exigencies or through lack of experience on the part of the surgeons to whom they were assigned, had not received such treatment.

Parker[11] who served as a civilian consultant during the last war stated: "The first observation is in great contrast to the observation of World War I, in that the incidence of infection of the soft tissues and the bone is lower . . . the second observation is that there has been more intelligent effort to stabilize the bones of the face and jaws in a more nearly normal, anatomic relationship."

It is natural to feel that it was the mutual understanding between the general surgeon and the dental surgeon as to the part that each should play and the responsibility that each should assume that made the plastic-maxillofacial services function so well.

Waldron[12] said:

> The high standard of surgical care in World War II and the excellent results thereby secured have been largely due to the broad policies and guiding principles presented from time to time by the professional division of the Surgeon General's office. The accumulated data of extensive experience have confirmed the soundness of certain principles and have formed a basis of modification of others. This holds true for maxillofacial surgery, which has been covered by teams consisting of plastic and dental oral surgeons. This efficient and cooperative teamwork should not terminate with war activities. It can be continued and developed in the care of civilian and industrial accidents, to the great advantage of the patients concerned. By and large, civilian patients with extensive lacerated facial wounds, associated with compound fractures, have not had such efficient and skilful care as that of the maxillofacial units of the services, which has been progressively modified and improved.

During the last war 254 army general hospitals were activated. Of this number 210 went overseas and twenty-three maxillofacial teams were set up. There were in addition numerous other hospitals such as evacuation and convalescent hospitals and hospital stations.

Assigned to these hospitals was the best of medical talent, surgeons and physicians, many from medical school faculties, and others who had been chiefs of service from large hospitals; and assigned with them were a certain number of oral surgeons.

My sincere belief is that the oral surgeon who served in time of war proved himself worthy and assumed responsibility when it was offered.—*DuPont Building.*

---

11. Parker, D. B., Observations on the Definitive Treatment of Maxillofacial Injuries. *J. Oral Surg.* 3:320 (October) 1945.

12. Waldron, C. W., Maxillofacial Wounds. *J. Oral Surg.* 3:269 (October) 1945.

CLASSIFICATION OF EXTENSIVE CYSTS OF THE JAWS

G. Victor Boyko, D.D.S., M.S.,
Paterson, N. J.

The responsibility for diagnosis and treatment of cystic lesions involving the jaws belongs to the oral surgeon. Because of his advanced studies in anatomy, physiology and pathology of the oral tissues, he possesses the additional technical knowledge necessary to appreciate the functions and esthetics of the tissue structures associated with the jaws. The primary object of the surgeon may be the elimination of a pathologic lesion in order to cure and restore the function of the involved tissues; however, the oral surgeon has the additional concern of rectifying disfigurement of the oral tissues. The necessity for evaluation of a normal facial appearance and the restoration of a good alveolar ridge without muscular adhesions, for the support of prostheses, is apparent to everyone.

Cystic growths of odontogenic origin involving the maxilla and mandible may form extensive tumor masses. The degree of extension and the size of the growth as well as involvement of adjacent structures depend on the duration of the growth and the amount of stimulus to it.

In the mandible the entire body and the ramus may be involved. Usually the involvement is unilateral, although bilateral extension is not unusual. The contents of the mandibular canal generally are forced to one side or below the cystic membrane. The usual clinical symptoms of crepitus and enlargement of the jaw may be felt or seen only when the growth has increased sufficiently. The cystic sac with its contents eventually may break through the bony mandibular wall and become attached to the adjacent soft tissues buccally or lingually.

In the more extensive cystic growths of the maxilla the antrum may be obliterated completely. Usually the antral lining is intact but has been compressed so that the antrum, as such, has been obliterated. In some cases the cystic contents may rupture into the antrum with subsequent discharge from the nose, simulating chronic sinusitis. Extension through the antrum and lateral wall of the nose into and through the floor of the orbit is not uncommon. A backward extension may break through into the pterygoid fossa and pterygoid venous plexus.

Since my primary purpose is the presentation and discussion of various procedures and technics in the treatment and removal of extensive cysts of the maxilla and mandible, I shall not enter into a lengthy discourse on the classification of cystic entities. A concise review of the more common cystic growths involving the jaws should serve. The groups will be discussed in order of their interest to the profession as regards tissue damage and differential diagnosis.

Common Cystic Growths

The most commonly occurring cyst is of the radicular or radiculodental group. Various hypotheses have been put forth relevant to its genesis. The most widely accepted theory is that it develops through an inflammatory stimulation of epithelial cell rests found in the periodontal tissue. However, this group of cystic growths,

Read at the twenty-ninth annual meeting of the American Society of Oral Surgeons, Boston, July 31-August 2, 1947.

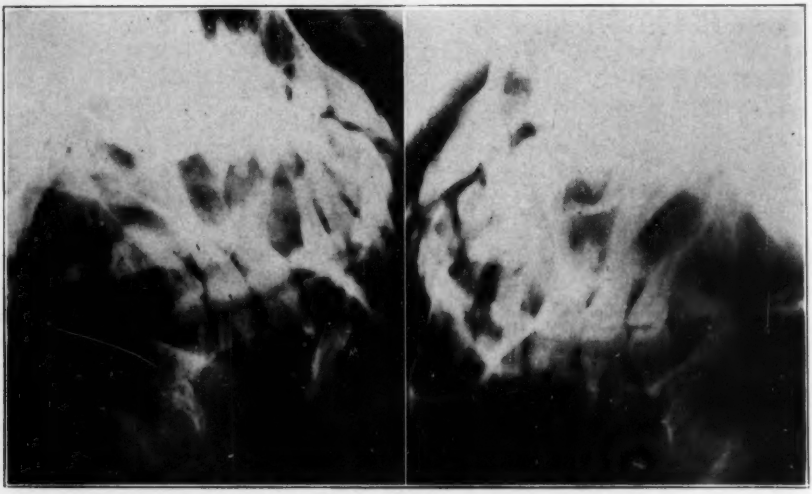

Fig. 1.—Left: Unerupted tooth in position of bilateral dentigerous cyst of left side of mandible. Right: Right mandibular view of bilateral dentigerous cyst

which may involve any tooth in either jaw, usually is detected during routine oral examinations and treated before extensive tissue damage has occurred.

The second group of cystic lesions comprises the follicular type. This group, which has been subdivided by Thoma[1] into (1) simple, (2) dentigerous, (3) periodontal, (4) cystic odontomas and (5) multiple cysts, is based on both irritative and inflammatory causes. The most generally accepted theory is that at some stage during tooth development retrograde changes take place in the stellate reticulum with subsequent enlargement of the enamel organ through a perifollicular transudate. The stage at which these changes occur determines the type of follicular cyst.

The term dentigerous cyst, which implies tooth bearing, should not be used ambiguously to include every type of cyst of the jaw of dental origin. Cysts of the dentigerous group, which form after the enamel organ has produced the crown of the tooth, always have a tooth remnant within the sac-lined bone cavity. Therefore, the dentigerous cyst is the tooth bearing type of the general classification of follicular cysts (Fig. 1).

The third type of cystic growth and one which, without doubt, requires the most care and judgment in its removal is the cystic ameloblastoma. The term adamantoblastoma, which is used synonymously with ameloblastoma, may have the advantage over the latter term in classifying this form of tumor on a histopathologic basis. Suffice it to say that this type of cyst arises from epithelium which is potentially enamel organ. It is commonly accepted that the ameloblastoma may develop from odontogenic tissue at any time during tooth formation.

Of the remaining and less common cystic tumors, the median, nasopalatine and globulomaxillary, little need be said except that they form from residual embryonic epithelial cell remnants which are not of odontogenic origin (Fig. 2). Consequently, they should be differentiated from odontogenic cystic growths. However, the operative procedures described herein may be applied and modified if necessary.

1. Thoma, K. H., *Oral Pathology*. St. Louis: C. V. Mosby Co., 1941.

Fig. 2.—Median palatal cyst of maxilla. This lesion is not of odontogenic origin

A type of cystic lesion involving the jaws, which, although not of odontogenic origin, is of interest from the standpoint of differential diagnosis and operative treatment, is the traumatic or hemorrhagic bone cyst. Histopathologically the lesions of this classified group contain no definite cystic membrane or epithelial cell structure characteristic of odontogenic cysts. However, a thin connective tissue wall may outline this lesion vaguely or be distributed irregularly throughout the mass. The traumatic bone cyst, as the name implies, is associated directly with injury to the jaw resulting in intraosseous hemorrhage but without associated bone fracture. The contents of these cystic masses consist of the degenerated clot resulting from the bone hemorrhage together with a serous transudate which, because of its internal pressure, tends to cause enlargement of the bony cavity. During certain stages of bone degeneration these lesions may be diagnosed as fibrous osteitis, showing evidence of microcomminution and organized hemorrhage compatible with the fibrosing stage of the traumatic bone cyst. Any long bone in the body, under similar circumstances, may show resulting lesions characteristic of this group.

Roentgenography

The roentgenogram remains the important factor in the preoperative differential diagnosis of various cystic growths. The radicular cyst, with its apparent genesis

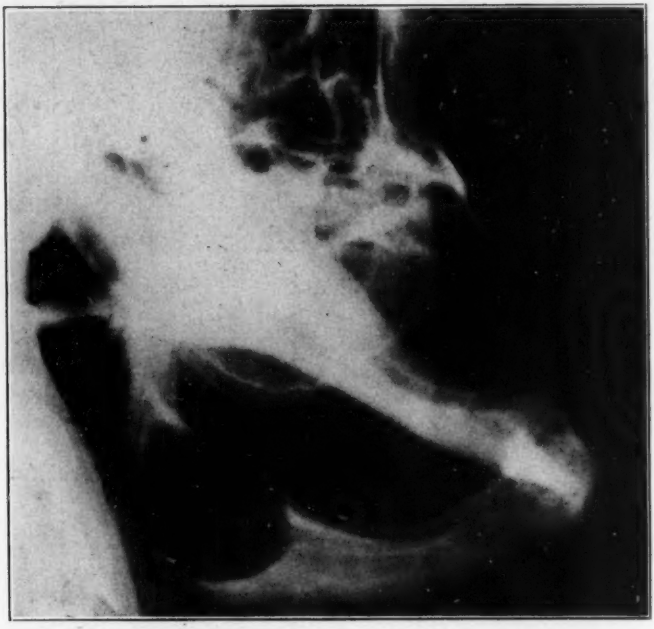

Fig. 3.—Simple follicular cyst of left side of mandible

in the periapical regions of the involved teeth and its subsequent extension, may be recognized readily. The large follicular cyst, however, must be differentiated not only from its different types but also from the radicular cyst and the ameloblastoma. The simple follicular cyst must be differentiated from the residual cysts (Figs. 3 and 4). The dentigerous cyst is recognizable by the fully or partially formed tooth included in the cystic sac. The multiple follicular cyst must be differentiated from the multilocular ameloblastic type. The ameloblastic cyst, in many cases, may be recognized by the indefinite line of demarcation between it and the surrounding bone. In most cases definite infiltration and erosion by the ameloblastic tissue is evident in the roentgenogram.

In combination with roentgenographic study, Lipiodol (E. Fougera) may be used in maxillary lesions in order to determine the extent of the cystic growth, whether the cyst has opened into the antrum, or to what extent the antrum has been displaced by the growth.

Comparative Study

Certain cystic lesions require a comparative study for their differentiation not only from other types of cysts but also from other tumor growths such as the giant-cell tumor or sarcoma, osteitis fibrosa cystica (local or systemic in character), the traumatic or hemorrhagic bone cyst, osteofibroma and malignant lesions (Figs. 5-7). After correlation of the roentgenogram, clinical findings, history and laboratory studies, aspiration biopsy or several tissue examinations may also be required to confirm a preoperative diagnosis. Every specimen of tissue removed at operation

Fig. 4.—Residual cyst of right side of mandible, showing bilateral involvement

should be submitted for histopathologic study so as to verify the diagnosis. This is particularly essential in connection with the open or Partsch procedure for treatment of cysts which may be potential ameloblastomas and which require more radical operation (Figs. 8 and 9). In most instances, a pathologist competent in oral pathology is a necessary adjunct to the success of an operation.

Surgical Treatment

The principles governing surgical treatment of large cysts involving the jaws follow one of several approaches: (1) surgical enucleation of the cystic membrane or excision of the lesion, (2) the open or Partsch procedure, (3) drainage, which utilizes a foreign body for establishing persistent drainage of the cystic cavity until healing takes place, or (4) the combination of any of these approaches. In cases of aberrant or infiltrating types of growths involving extensive regions, as illustrated by the ameloblastoma, more radical resection of the diseased tissue may be required. X-ray and radium irradiation has been added as a necessary adjunct to the field of surgery in the treatment of the more extensive and malignant lesions. Irradiation may be used alone or in conjunction with surgical procedures in accordance with the prevailing judgment of the operator.

Fig. 5.—Left: Giant-cell tumor of maxilla which may simulate a cystic lesion. Right: Adamantinoma of maxilla. This lesion is histologically malignant

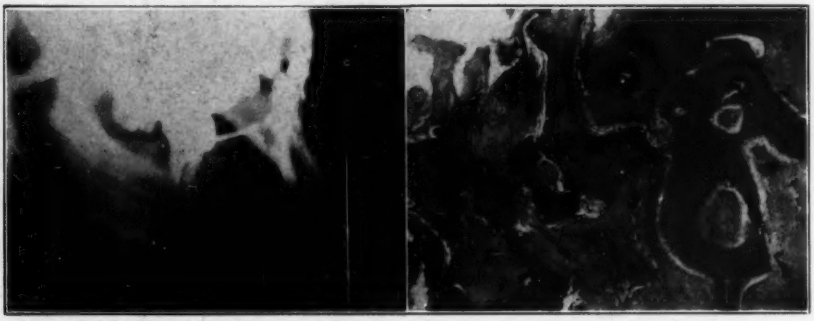

Fig. 6.—Left: Left side of mandible, showing lesion of osteofibroma. Right: Photomicrograph of lesion, showing great increase of fibrous tissue and appearance of bone in bands

The technic of operative procedure adopted by the surgeon may depend on several factors, namely (1) the type of cystic lesion, (2) location of the cyst and tissues involved, (3) age and health of the patient and (4) experience and judgment of the operator.

Surgical enucleation of the cystic membrane is most commonly and appropriately performed in the treatment of cystic lesions which do not involve essential teeth or vital tissue structures (Fig. 10). This method, moreover, is compulsory if cystic membranes reveal ameloblastic tissue cells which show malignant tendencies. If essential teeth are exposed within the cystic membrane such teeth may be retained as pulpless teeth after their devitalization. Many teeth which have been condemned because of involvement of their pulp may temporarily be left in position to act as a supporting structure for the healing granulation tissue until the appropriate time for their extraction.

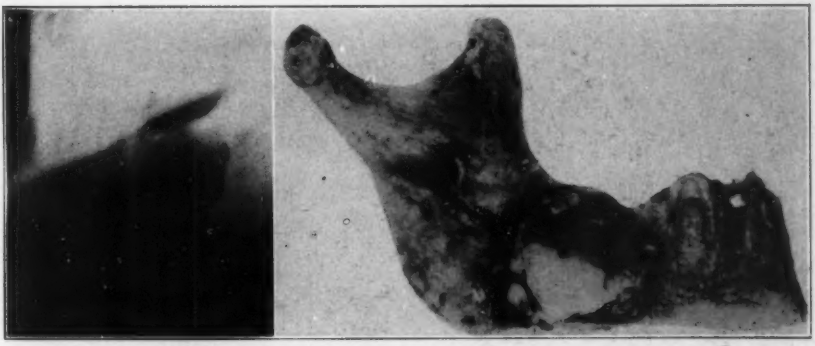

Fig. 7.—Left: Left mandibular spindle-cell sarcoma which simulates a cystic lesion. Right: Gross specimen of resected mandible, showing attached malignant lesion

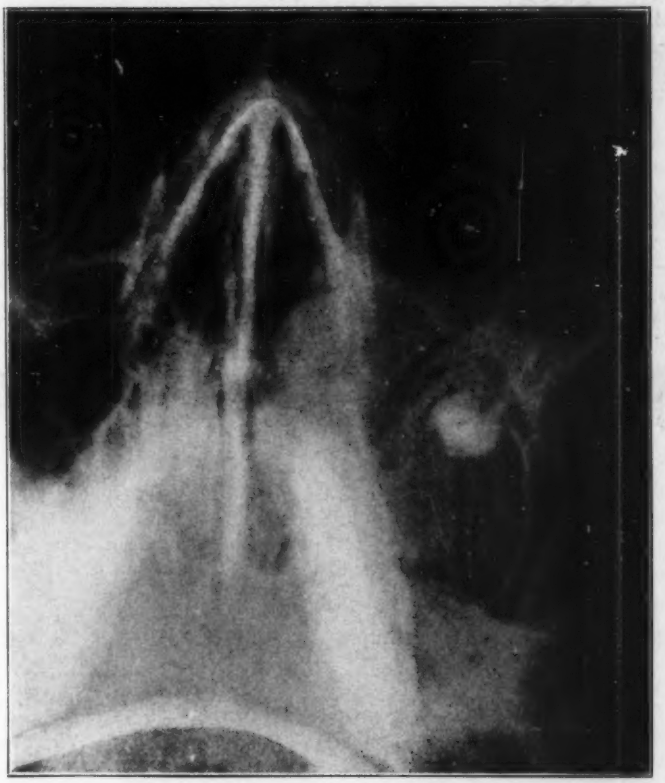

Fig. 8.—Dentigerous cyst of left side of maxilla. After biopsy this cyst revealed an intracystic ameloblastic papilloma

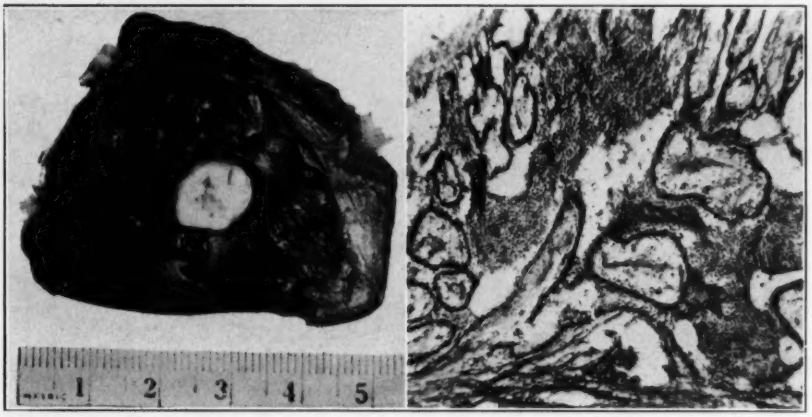

Fig. 9.—Left: Gross specimen of enucleated lesion shown in Figure 9. Right: Arrangements of ameloblastic tissue cells in histopathologic specimen of lesion shown in Figures 8 and 9, left

The open or Partsch operation may be adopted as a more conservative procedure in the treatment of extensive cysts of the jaw which encroach on vital structures such as the antrum, nasal cavity, orbital region or mandibular canal (Fig. 11). This procedure, when appropriately selected, conserves tissue because it is limited to the surgical excision of a window in the most accessible portion of the cystic lining, the surface mucous membrane thereby making the cystic cavity a continuous or an accessory part of the oral cavity. The technic of the procedure is simple and may conserve many teeth and vital tissue structures. In order to maintain cleanliness and stimulate healing in the deeper cystic cavities an obturator may be constructed to conform to these accessory cavity depressions.

Another conservative method advocated by certain authors is the use of a foreign body in the form of a tube or metal tape for establishing persistent drainage of a cystic cavity. This approach may be utilized to conserve teeth and vital tissue structures, as an alternative to the open or Partsch operation. With repeated irrigations for drainage and cleanliness these cystic cavities, under this treatment, become smaller in size until the cystic membrane becomes united with the surface mucous membrane.

Circumstances may require the use of these surgical approaches in a combined or modified form. An extensive mandibular cyst may require surgical enucleation of the portion involving the ramus, whereas an open procedure may be appropriate for the cystic lesion involving the body of the jaw, because of the teeth and mandibular region involved. In other instances, the drainage or open procedure may be utilized in the first stage of an operation for conservation of vital tissue structures; the second stage, after sufficient healing has protected the vital tissues, may consist of surgical enucleation without endangering the essential structures.

Postoperative Results

Certain requirements in operations on the jaw are necessary for satisfactory postoperative results. Experience on the part of the operator tempers his surgical judgment and favors good prognoses. In most instances, the disease process of the pathologic lesion has already accomplished its damage to the tissues at the time the

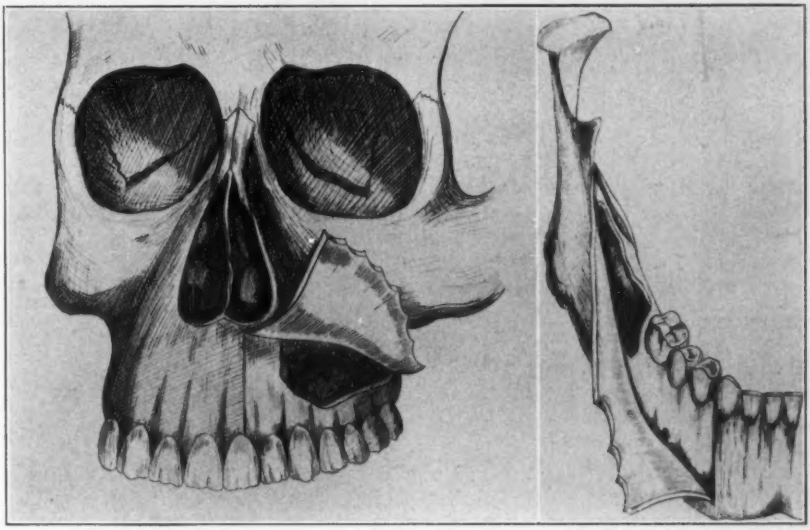

Fig. 10.—Left: Surgical approach for removal of massive cysts involving the maxilla. Right: Surgical approach for enucleation of cysts involving the mandible. This approach may be modified according to location and size of cyst

patient seeks consultation. The duty of the oral surgeon now becomes one of efficient preoperative judgment, operative skill and persistent postoperative care in order to achieve a cure with good functional results. A neglected wound complicated with secondary infection and distorted tissue flaps may result in a variety of deformities. Persons with malformed alveolar ridges and jaws have taxed the abilities of prosthodontists to keep their patients comfortable and happy with dentures and restorations.

The oral surgeon recognizes the value of the important muscles related to the function and appearance of the mandible, such as the mentalis, buccinator, genioglossus, mylohyoid and the superior constrictor muscles (Fig. 12). The mentalis and the buccinator muscles are easily injured by disease or surgical manipulation. The muscles of the maxilla are the buccinator, caninus and nasalis, including the depressor alae nasi, as well as the labial frenum. Relatively less muscle damage, affecting function of the jaw and requiring artificial restorations, may result about the maxilla, because of its fixed anatomic position (Fig. 13).

Adherence to the following points may aid in contributing toward good surgical results as related to large cysts of the jaw.

Study of the preoperative roentgenogram.—Once the diagnosis has been established the operation may be planned with respect to tissue involvement as revealed in the roentgenogram. The proximity of the cystic lesion to vital structures such as the teeth, sinuses, nose, orbital cavity, mandibular canal and adjacent soft tissue should be taken into consideration. These factors will determine whether the type of operative procedure will be surgical intervention, drainage, irradiation or a combination with modification of any of these approaches. The more radical procedure of resection of the jaw or the use of cautery may be required for the infiltrating lesions.

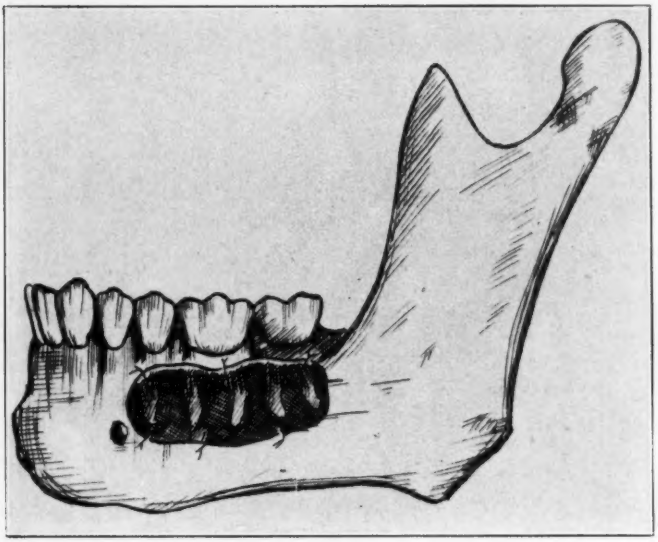

Fig. 11.—Surgical approach in open or Partsch procedure for cysts of the mandible

Preoperative examination of the lesion.—The diseased area may now be examined to determine the type of incisions to be used. The location of the lesion determines whether the primary incision will be along the gingival margin or 1 cm. below the cervical margin. The primary incision is appropriately made over the thinnest wall and most accessible portion of the cystic mass but with the object of preserving as much of the alveolar ridge as possible. Muscle insertions with their bony attachments should be taken into consideration in cases of surgical enucleation or resection of the jaw. If an obturator or drainage appliance is used in the open procedure the relation of this appliance to the artificial restoration should be appreciated.

Health and age of the patent.—The condition of the patient with regard to age and health bears an important relation to the operative procedure and postoperative result. For obvious reasons, the surgeons will be more conservative in dealing with lesions affecting the sick and aged.

Tissue trauma and tissue flap positions.—The open method or Partsch procedure for treatment of extensive cysts of the jaw involves the least amount of tissue manipulation and trauma, which is in its favor. Tissue trauma is always a factor in the more extensive resections of the jaw. However, the gentle handling of tissues in radical surgery aids toward good prognoses. Proper soft tissue approximations will minimize tissue adhesions and deformities. For this reason appliances for retention of bony fragments in a functioning position should be made preoperatively in all instances of extensive tissue loss.

Postoperative care of wounds.—The treatment of surgical wounds terminates only when complete healing has been achieved. All precautions, including wound and mouth hygiene and systemic chemotherapy, should be utilized to control secondary infection and promote healing. During the prolonged care of an extensive

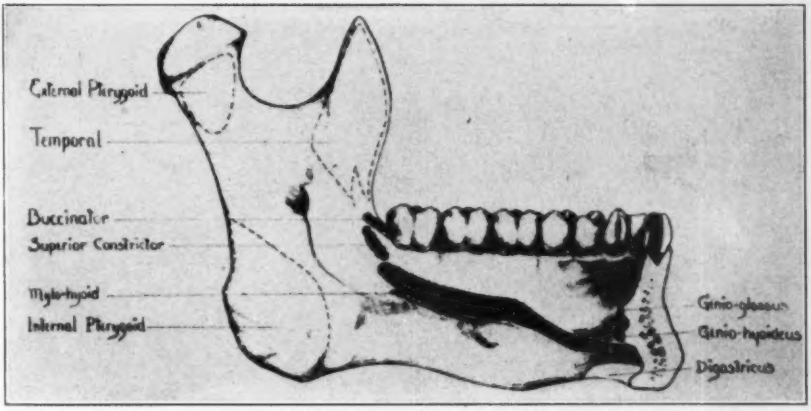

Fig. 12.—Internal border of mandible, showing important muscle attachments

wound, muscle distortion or tissue deformity resulting from tissue adhesions should be avoided or corrected as soon as conditions warrant. Position of soft tissues may be improved by placement of accessory sutures for restoration of the tissue margins to a proper approximation or by utilization of a foreign body, such as the rubber tissue or tube, to undermine a tissue flap or support it in a position of functional attachment.

At appropriate periods during the healing of an extensive surgical wound, exercises for prevention or correction of muscular adhesions or deformities may be performed by the patient under the guidance of the oral surgeon. Forceful gargling with blowing outward of the muscles of the lip and cheek may help to prevent the fibers of the buccinator muscle from adhering to the fibrous tissue of a healing wound. As an adjunct to exercises physiotherapy in the form of light therapy or short wave diathermy acts in a twofold capacity: (1) it encourages the patient at home to follow instructions relative to mouth hygiene and exercises and (2) the production of local hyperemia of the tissues, resulting from this form of therapy, acts as an aid to other procedures. These functions will encourage the patient to give his cooperation in order to secure the best final results.

Comment and Conclusion

The classification of cysts involving the mandible and maxilla reveals the ameloblastoma as the most complex from the standpoint of diagnosis and prognosis. It is of interest to note that the extensive dentigerous and follicular cyst may be a potential ameloblastoma. For this reason a preoperative biopsy may be essential in all extensive cysts of the jaw so as to detect ameloblastic tissue which may determine the type of operative procedure.

The surgical procedures advocated in the treatment of large cysts of the jaw are (1) surgical enucleation or excision, (2) the open or Partsch approach, (3) drainage, (4) irradiation or (5) a combination or modification of these procedures. Surgical enucleation or resection is compulsory in all instances of cystic lesions showing ameloblastic tissue elements. The judgment of the operator will determine the type of procedure and contribute toward the prognosis.

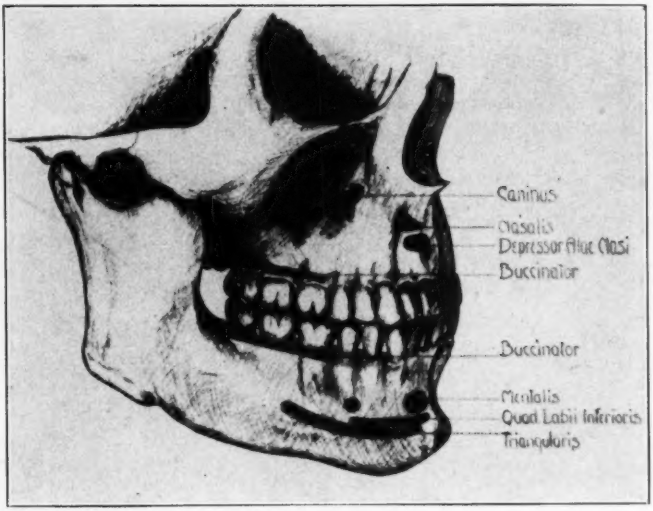

Fig. 13.—External maxilla and mandible, showing related muscle attachments

Postoperative care is important in achieving a good final result, particularly in wounds that heal slowly. Early detection or correction of adhesions or malposed tissue margins, or the use of rubber tissue supports may prevent deformities. Physiotherapy and cooperation of the patient are concluding factors which are effective toward a good prognosis.—*64 Hamilton Street.*

Cancellous Bone Grafts to the Jaw. R. G. Blocker, Jr., in *Surg., Gynec. & Obst.* 84:553 (April 15) 1947.

In addition to 68 bone grafting procedures to the mandible in 66 patients, cancellous iliac grafts have been employed for restoration of contour in 18 deformities of the maxilla, 5 of the nose and 2 of the supra-orbital margin. Drainage occurred in one instance, but successful final union was obtained in every one of these cases.

In summary, we believe that iliac block grafts of pure cancellous bone form the most satisfactory material for relief of large and small bony defects in the mandible. The large percentage of cases without failure cannot be attributed to the choice of graft alone, however. We must not overlook the value of chemotherapy in the treatment and prevention of infection nor disregard the importance of suitable mechanical fixation of fragments. Above all, we must not forget that the background of all transplantation procedures is the proper preparation of the tissues themselves. In no other branch of surgery is the old adage so true that "haste makes waste."

USE OF THIOPENTAL SODIUM IN DENTAL SURGERY

Harold W. Krogh, D.D.S.
Washington, D. C.

The growing opposition to the use of general anesthesia in dental offices is alarming and should be recognized and overcome by the profession. The chief objection has been based on the anoxia which unhappily may result from the administration of nitrous oxide, the general anesthetic most commonly employed in dental surgery. Criticism has been directed at the intrinsic deficiency of the agent rather than at the men who employ it. In view of this, I should like to suggest a more general use of the agent thiopental sodium (Pentothal sodium, Abbott) as a solution to the problem of anoxia. It is my purpose to discuss the anesthetic properties of the drug as they relate to dental surgery; to describe a successful method for administration of the drug in dental offices, and to refute the mistaken conception that thiopental sodium is unsuitable for light anesthesia in dental surgery.

Thiopental sodium is a short acting barbiturate (thiopentobarbital sodium), which was introduced clinically by Lundy[1] at the Mayo Clinic in 1934 and was first used without nitrous oxide-oxygen supplement in routine dental office practice by Hubbell[2] in 1940.

According to Adriani,[3] thiopental sodium has the following pharmacologic effects: it depresses the cortex, does not stimulate the vomiting center, lowers the blood pressure slightly; does not increase intracranial pressure, increases the heart beat without disturbing the rhythm, gives poor muscular relaxation, raises the skin temperature, does not abolish and may cause hyperactivity of the pharyngeal and laryngeal reflexes, raises the blood sugar slightly and does not damage the kidneys. It is rapidly destroyed by the liver and other tissues, chief of which is probably the reticuloendothelial system.

Advantages

It is apparent that for the dental surgeon thiopental sodium has many virtues and only one defect, that is, the possible initiation of pharyngeal or laryngeal spasm. It is now believed that the drug, by itself, does not cause spasm, but rather that spasm is initiated by such stimuli as postnasal drainage, blood or mucus in the throat, or such mechanical factors as traction on the tongue, the pharyngeal aspirator or an improperly adjusted nasopharyngeal tube. The careful surgeon can avoid producing most of these stimuli and, in addition, if the anesthesia is light enough so that the cough and swallowing reflexes are not lost, spasm is unlikely to occur.

The drug is dispensed in glass ampules of various sizes. For use it is dissolved in sterile distilled water. Most widely used is a 2.5 per cent solution, although 5, 3.33, and 2 per cent concentrations are also adaptable to dental anesthesia. I have found

Read at the eighty-eighth annual meeting of the American Dental Association, Boston, August 4-8, 1947.
Department of Surgery, School of Medicine, George Washington University.

1. Lundy, John, *Clinical Anesthesia*. Philadelphia and London: W. B. Saunders Co., 1943.
2. Hubbell, Adrian, Personal communication.
3. Adriani, John, *The Pharmacology of Anesthetic Drugs*. Springfield, Ill.: Charles C. Thomas, 1946.

a 2 per cent solution made by dissolving 10 gm. of powder in 500 cc. of distilled water most satisfactory.

Thiopental sodium may be administered intravenously by glass syringe, Hubbell injector or drip method. The drip method is too slow for dental surgery. The drug may be used alone or in combination with other anesthetic agents and with or without premedication.

In general, persons difficult to anesthetize with the usual agents will require larger amounts of this agent, and the converse is also true. Thus the adolescent, the alcoholic, the excessive smoker, the athlete, and high-strung and redheaded patients will take larger initial and maintenance doses than the obese, the aged, the anemic or the composed person, or the patient in shock. Of course, those bodily states or diseases which make the use of other anesthetics hazardous apply to the use of thiopental sodium, but in slighter degree.

It is presumed that anyone who can walk a block and sleep on less than two pillows may be given thiopental sodium. Accordingly, it is not my practise to have the patient's general condition checked by a physician. My anesthetist takes careful note of the pulse, with especial concern for its rhythm, and must be alert to detect edema of the extremities and marked shortness of breath, the clinical signs of cardiac decompensation.

Premedication

Premedication is not used because it is not necessary and it has the undesirable effect of prolonging the period of postanesthetic recovery. That less of the agent is needed for patients who have been premedicated is rarely an important consideration. In the earliest cases in which I used thiopental sodium, atropine sulfate was given hypodermically before operation; in later cases atropine was combined with the anesthetic in the first syringe, and in the most recent 2,500 cases no atropine has been used. To be sure, salivation is somewhat increased but seldom to the point where it becomes annoying. The incidence of laryngeal spasm is no greater without atropine, and the patient is more comfortable without the dryness which it produces. Omission of premedication has one relative disadvantage: the veins are not well filled, as they are if it is employed. Fright is known to constrict the peripheral vessels, and, since most patients are frightened, the skill of the anesthetist must overcome the decreased accessibility of the veins. Because of the psychic factor, pulse rates, too, run high, many reaching 140.

Many patients are fearful of a general anesthetic because they think that under its influence they may do or say something undignified. Because there is no excitement stage with thiopental sodium, one can safely assure the patient that there is little possibility of either reaction. This is no small advantage.

Administration

I shall now describe a method of administration in the office, which has been successful for more than 8,000 of my patients who have been anesthetized with thiopental sodium.

It is preferable that patients abstain from food and drink for at least four hours preceding operation, although this is not as important as with other anesthetic agents since thiopental sodium does not stimulate the vomiting center. Patients are requested to empty the urinary bladder before seating themselves in the operating chair. The chair is adjusted with the seat inclining backward and the backrest quite straight, to keep the patient from sliding down and forward. The headrest is placed

so that the occlusal plane of the lower teeth when the mouth is open is approximately parallel to the floor. The resulting position of the head tends to keep the tongue well forward so that it will not become an obstacle to a free airway. Men's collars and ties are loosened; women's high-heeled shoes are removed to prevent the patients from turning their ankles. The arm board is adjusted to allow a bend at the elbow, which prevents possible injury to the brachial plexus if the patient should slump. After the patient is settled the pulse is taken, the site of venipuncture is prepared and the tourniquet is applied. While these preparations are being made the proposed operation is checked, the instruments are selected and the patient is reassured. Venipuncture is now made, and the initial dose is given rapidly, the mouth prop being placed after about 5 cc. has been injected. A 20 gage needle is used because smaller gages do not permit rapid enough flow. When the patient loses consciousness, a cotton throat protector is placed about midway on the dorsum of the tongue. The protector is a lightly rolled cylinder of cotton about 3 inches long and 1 inch in diameter. It is not intended to keep air from the throat but only to protect the throat against foreign bodies and to absorb blood or saliva. Next, a 3-inch square of gauze is placed over the cotton along the side of the tongue with the lower edge extending between the tongue and lower teeth, the upper edge extending lingual to the upper teeth, and the posterior border closing the opening into the throat. This arrangement isolates the operative area, makes a good light reflector, keeps the aspirator from picking up cotton fibers, prevents anything from going down the throat and does not stimulate the pharyngeal reflex. When the gauze becomes saturated with blood or saliva it is changed without disturbing the cotton. The instruments are now uncovered and the depth of anesthesia is checked. If the estimated dose has been accurate the lash reflex will be diminished or absent and the operation may be started. If the lash reflex is too active more solution must be injected and a short interval allowed for it to take effect; as the need arises, additional solution in small amounts is injected intermittently until the operative procedure has been completed.

Dosage

For short operations an attempt is made to give an initial dose sufficient for the duration of the operation. The amount of the initial dose is predicated on many factors, including age, general health, body weight, nervous state, character of and estimated time for operation, and, perhaps, race. The surgeon must time the depth of the anesthesia with the sequence of technical steps because different tissues vary in the pain stimuli to which they will react. Thus deeper anesthesia is needed for incision of gingival tissue, stripping of mucoperiosteum and removal of teeth than for cutting of bone and placing of sutures. Advantage is taken of this fact by having the anesthesia deeper at the beginning of the operation than at the finish. Recovery will be more rapid if the initial dose induces sufficient anesthesia for surgical exposure than if a small initial dose is gradually added to until the desired depth is reached. Although the latter method is excellent for the inexperienced operator, it does not take full advantage of the agent.

I believe that dental surgeons should employ competent anesthetists who may know more than they about anesthesia in general. However, to get the best results from thiopental sodium, it is necessary for the dental surgeon to know the action of the drug thoroughly. Only he knows whether the work is being done in a painful region and when he will finish. This information is communicated to the anesthetist so that the depth of anesthesia is never greater than that required for the surgical

procedure. He must be alert for respiratory sounds and must maintain the tongue and head in the proper position. He must see that wet sponges are changed and that the throat protector is correctly placed. It is also essential that he be able to use a pharyngeal aspirator.

Control of Complications

It is necessary to remove accumulations in the piriform space in order to prevent their overflow and aspiration into the trachea. Patients with postnasal drainage often require aspiration, and the secretions of some heavy cigaret smokers are particularly difficult to manage. Vomiting during operation is extremely rare but it can occur.

It is essential that oxygen be immediately available in the event of laryngeal spasm, but oxygen can be given advantageously through the nasal inhaler for patients with other complications such as circulatory disease, anemia and respiratory defects, and for those in poor general condition. Patients with cardiac disease must be handled cautiously, and, since a high concentration of oxygen is beneficial to damaged circulatory systems, 100 per cent oxygen at about 3 mm. pressure is continuously administered to these patients.

Occasionally syncope will occur just as the injection is started. The unconscious patient is placed in a horizontal position and given oxygen until normal circulation is re-established. The operation may be performed with the patient in that position or he may be returned to the upright position.

Nitrous Oxide and Oxygen

Nitrous oxide and oxygen is a valuable adjunct to thiopental sodium in some conditions and is usually administered in equal amounts, although this proportion can and should be changed to suit the individual subject. The oxygen content, of course, should never be less than 20 per cent. It may be added for patients in their middle teens and occasionally for those in the late teens to shorten the period of postanesthetic recovery, and for adults, if an unduly large amount of thiopental sodium is needed to induce and maintain an adequate level of anesthesia. Those in the early and middle teens take the anesthetic well, but the postanesthetic period tends to be one of confusion and restlessness so that it is sometimes necessary to assign a nurse to care for the patient. This is disturbing in a busy practice and can largely be eliminated by administration of a basal anesthetic such as thiopental sodium, after which the anesthesia is maintained with nitrous oxide and oxygen, although additional thiopental sodium may be given if desired. Nitrous oxide and oxygen is also of advantage for those patients in whom pharyngeal or laryngeal spasm is difficult to control, since the nitrous oxide depresses the pharyngeal reflex. However, I prefer to work without this supplement because the anesthesia tends to become deeper than needed, postoperative nausea seems to be increased, and the nosepiece is in the way of operations in the upper anterior region.

A nasopharyngeal tube can sometimes be used to maintain the airway. It is most helpful in those cases in which thiopental sodium is supplemented by nitrous oxide and oxygen. The tube should extend just below the base of the tongue but not to the glottis. The patient must not be too lightly anesthetized, when the tube is inserted, or pharyngeal spasm may be initiated. The nasopharyngeal tube should be used sparingly because it may cause annoying postnasal bleeding. I use tubes of various sizes with flanged nasal ends so that the nosepiece of the gas apparatus can fit over them without forcing the tube into the nose.

Postoperative Care

Postoperative care begins with removal of the mouth prop and insertion of sponges to control bleeding. Sponges are changed as the need arises until bleeding stops. It is not always easy or possible immediately to keep the sponges in place, because under light anesthesia the patient may chew them or spit them out. At this stage most patients are suggestible, however, and the nurse can press upward on the chin and ask the patient to close the mouth. This state of suggestibility is utilized further to transfer the patient from the operating chair to the recovery room. The patient is urged to move himself over onto a wheeled chair and from the chair onto the bed, where he should be turned on his side. Most patients will not remember these maneuvers. The patient should not be allowed to lie on his back until after he has fully recovered, because the tongue may drop back and embarrass respiration or blood may be swallowed, causing nausea and vomiting.

The postoperative procedure is most important, and one attendant should be assigned to care for and dismiss patients. This is in accord with the best hospital practise and pays dividends in uncomplicated recoveries. The patient does not know how skillful the surgeon is. All he knows is how he feels and how he is treated while he is regaining consciousness. As soon as he feels able he may sit up, and should be given a cup of black coffee. The question of when to allow the patient to assume a sitting position is one which is not yet satisfactorily solved in my practice. Transitory diplopia and dizziness occur early in the postanesthetic state. The diplopia causes no trouble, but I believe the patient's head should be kept on the pillow until the dizziness is past, because of the possible sequence of vertigo, nausea and vomiting. If the patient becomes nauseated, the operation, no matter how technically perfect, is usually a failure from his point of view. Patients should not be dismissed carelessly, although the importance of this step at times has been overemphasized. It is desirable, but not absolutely essential, for patients to be accompanied home; however, they should be forbidden to drive themselves.

Patients who have had thiopental sodium require less than the usual doses of postoperative sedation. The postanesthetic effects of the drug are prolonged if barbiturates are prescribed to control pain. For this purpose codeine or aspirin, alone or in combination, will be found to be effective. Because of the synergistic action of morphine and thiopental sodium, more than 1/6 grain of morphine should not be given.

Status of Anesthesia in Dentistry

I will now discuss the opposition to nitrous oxide-oxygen anesthesia, the difficulty surrounding the introduction of thiopental sodium into office practice, and the misconceptions regarding its properties as they relate to dental surgery; and I will outline a method of study to be pursued before adoption of the drug into the practice of dental surgery.

Our profession fathered and grew up with nitrous oxide anesthesia, developed its own technics of anesthesia and operating and accomplished wonders with them. It is not too much to say that the specialty of oral surgery was founded on nitrous oxide-oxygen anesthesia. The problem was to maintain anesthesia while the patient's mouth was open and he was breathing greater or lesser amounts of air. This led to preliminary saturation, throat packs, pressure gas machines and often great speed in operating. Because nitrous oxide does not produce profound anesthesia it was sometimes pushed beyond physiologic limits.

It was noted early that persons of certain types were resistant to nitrous oxide, particularly the athlete, the alcoholic, the excessive smoker, hypertensive and highly nervous persons and those with nasal obstructions. To operate successfully on persons of these types dental surgeons began to use premedication and to add to the nitrous oxide-oxygen mixture more potent agents such as ethyl ether or vinyl ether (Vinethene, Merck).

There is increasing pressure being put on our profession to eliminate the anoxia sometimes attendant on nitrous oxide-oxygen anesthesia. Already a bill has been introduced into one state legislature which would require dentists to use premixed gas containing 80 per cent nitrous oxide and 20 per cent oxygen. This would not eliminate anoxia caused by the gaseous mixture, but it would eliminate the use of nitrous oxide in dental offices.

Although the profession must be militantly opposed to such attempts to interfere with our prerogatives, criticism of our anesthetic practices must be faced. We operate in full view of the public and not in the sanctity of hospital operating rooms. Our infrequent accidents receive wide publicity and much unkind criticism from our medical colleagues. This criticism is based on two factors: the agent we most commonly use, and our allegedly inadequate training in anesthesia. We, as a profession, must establish and support centers for the training of dental anesthetists or we may lose the privilege of administering general anesthetics. Many hospitals now restrict to those with a degree of Doctor of Medicine the right to administer general anesthetics. This restriction is making a career in anesthesiology less attractive to nurses and so cutting down the source of dental anesthetists. I believe that this is a short-sighted policy on the part of the medical profession, since it will be generations before it can supply the number of trained doctors of medicine needed for hospital service, not to mention dental surgery. They forget that in most cities as many anesthetics are administered daily in dental offices as in hospitals. Because many patients fear dental operations as much or more than major surgery, they are entitled to the blessings of general anesthesia in either instance.

Thiopental Sodium

The first difficulty confronting the introduction of thiopental sodium in dental offices is that this agent, unlike nitrous oxide, was first used in hospitals by physicians to produce anesthesia for major surgery. This has led to great confusion and opposition from our medical friends, because they do not consider it safe or practical for use in the dental office. They think in terms of deep surgical anesthesia, the patient on the table inclined at 10 degrees in a modified Trendelenburg position, abolition of reflexes, muscular relaxation and long periods for recovery. They also want a patient well depressed by premedication. The general surgeon demands a perfectly still, well relaxed subject, insensible to most stimuli, and rapid institution of the state of deep anesthesia. We know that thiopental sodium used alone is not always safe under such conditions. In addition, most hospital anesthetists know little of post-anesthetic reactions, leaving that phase to the nurses, and early ambulation is for them not a problem.

Requirements Peculiar to Dentistry

I believe that much of our difficulty with physician anesthetists arises because they do not understand our problems and needs; and chiefly because of our different concepts as to what constitutes anesthesia. Most of the needs and problems of dental surgeons are quite different from those of general surgeons. We want light anesthesia

without abolition of reflexes, quick inductions and short periods of recovery. We do not need nor want muscular relaxation. Under these conditions patients do better in a seated position than in a modified, 10 degree Trendelenburg position. Dental surgeons are not accustomed to, nor do they demand, perfectly still patients. Accordingly, with thiopental sodium, most of our procedures can be carried out with patients in the first stage of anesthesia. In this stage the lash reflex is diminished or abolished; severely painful stimuli may cause slight movement of the voluntary muscles; the swallowing and cough reflexes are active; there may be phonation, and respiration is not depressed.

It is difficult for anyone who has never seen thiopentol sodium used in dental surgery to believe that the patient is anesthetized. He is in a state beyond analgesia and in a state of amnesia but he certainly is not anesthetized in the sense accepted by the general surgeon. If this point could be made clear generally, I am sure there would be less opposition to use of the drug in the offices of dental surgeons.

Clinical Action

Other obstacles to the use of thiopental sodium are the many misconceptions held by some dental surgeons regarding the clinical action of the drug. It is said that it takes too long for the patient to go to sleep, that respiration is markedly depressed, that patients must be kept in the office all day, that only short operations can be performed, and that extremes of age and many diseases contraindicate use of the agent. The actual situation is altogether different. Patients go to sleep in about 10 seconds, and respiration is not depressed in the first stage of anesthesia, the stage in which we should do our work. Thiopental sodium may be used for operations of any length considered advisable for ambulatory patients. The aged take the agent most satisfactorily, and Bullard and Brockett[4] have given it to large numbers of infants and small children with no ill effects. I know of no disease which of itself contraindicates use of the drug, but under some conditions it is inadvisable to administer it in the dental office. Among these conditions are fixation of vertebrae of the neck or cervical area, extreme degrees of hypertension, cardiac decompensation, bronchiectasis and ankylosis of the jaws.

Another misconception is that patients do not vomit after taking thiopental sodium. The avoidance of vomiting is a problem in the postanesthetic period after use of the drug but in much reduced form as compared with that after use of other general anesthetics. Although it does not stimulate the vomiting reflex, it is not always possible to manage the reacting phase so that vomiting will be avoided. Thus, if it is impossible to prevent the patient from swallowing blood, or if a patient easily becomes dizzy, nausea and vomiting may follow.

The time required for postoperative recovery may be somewhat longer for a patient who has had thiopental sodium than for one who has had nitrous oxide and oxygen, but when the decreased incidence of vomiting after the former agent is taken into consideration the average period of postoperative recovery is equalized and may even be shorter after thiopental sodium. In addition, the euphoric state produced by this agent makes the postoperative period a pleasant one for patient and operating staff. The postoperative depression of the few is almost unnoticed amid the general elation.

The third difficulty which may be found in the way of one who wishes to employ thiopental sodium in the practice of dental surgery is the conservative policy of the

4. Bullard, O. K., and Brockett, S. I., Combined Pentothal Sodium-Nitrous Oxide-Oxygen Anesthesia in Oral Surgery. *J. Oral Surg.* 3:138 (April) 1945.

pharmaceutical company which makes the drug. This reaction is quite justified considering the unfortunate experience of hexobarbital soluble (Evipal soluble, Winthrop), a promising agent which was sold indiscriminately, found its way into untrained hands and was soon discredited. Naturally, its manufacturer wishes Pentothal sodium to escape such a fate.

I hope that this presentation has aroused enough interest to stimulate employment of this valuable agent. Certain preliminary steps are essential to success in this venture. First, additional physical equipment may be necessary in the office, such as an augmented nursing staff, an increase in number of recovery rooms and the adoption of a rigid aseptic technic. One must be prepared to give up many of his present ideas concerning anesthesia, because I know of no one who has mastered the use of thiopental sodium who has not made it his principal anesthetic agent.

Method of Study

Those who are trained in the use of general anesthesia and wish to add thiopental sodium to their anesthetic agents may do so in the following manner: First, the dentist and his anesthetist should spend some time in a hospital where the agent is used and appreciated. Observation is not enough; intensive study is essential. It is necessary to learn how to inflate the lungs and desirable to learn to use a laryngoscope and to insert an intratracheal tube. Venipuncture may be learned and practiced at blood laboratories or syphilitic clinics. The dentist and anesthetist then should spend a few days in a dental office in which the drug is used routinely. The dentist's own use of thiopental sodium should begin with short operations on apparently normal patients with good veins. The initial dose should be given slowly with the patient counting aloud at intervals of one second. When the patient stops counting, about a half minute should be allowed to elapse before insertion of the mouth prop. Most patients will yawn shortly after they stop counting, and that is a good time for insertion of the prop. Any deficiencies of anesthesia during the operation may be overcome by injection of additional small amounts of thiopental sodium or by supplementing it with nitrous oxide and oxygen. As one becomes familiar with the agent, rapid induction without counting may be employed and longer and more difficult operations essayed.

Summary

This discussion has concerned itself with the anesthetic properties of thiopental sodium as they relate to dental surgery; a description of a method of administration in a dental office which has been successful in more than 8,000 cases; the mistaken conception that the agent is unsuitable for light anesthesia in dental surgery; the growing opposition to use of nitrous oxide-oxygen anesthesia in dental offices; the difficulties surrounding the introduction of thiopental sodium into office practice, and an outline for a method of study to be pursued before adoption of the drug into the practice of dental surgery.—*1835 Eye Street, Northwest.*

PRELIMINARY REPORT ON PENICILLIN OINTMENT IN POSTOPERATIVE MIXED INFECTION OF THE ALVEOLUS

Seymour Zeff, D.M.D.,
New York

The wide use of penicillin preparations in the past for various types of infections which occur within the realm of the dental and oral surgeon has drastically reduced the necessity for prolonged treatment of these infections. Weeks of constant treatment have been reduced to days, and days to a matter of hours in some cases. The number of penicillin preparations has expanded from the original sodium penicillin for intramuscular and intravenous use, and calcium penicillin for topical application, to include troches, coated tablets, the drug in emulsion or beeswax, for prolonged activity of a single massive injection, and ointment for topical application. This report is based on administration of this last form of penicillin for infection of the alveolus after removal of impacted teeth.

Postoperative infection of the alveoli, especially in mandibular third molar regions, occurs frequently despite complete surgical care by the operator. Maintenance of true asepsis cannot be expected during operations in the mouth. When an alveolus becomes infected prolonged treatment, usually painful and expensive, will often arouse the suspicion of the patient as to the skill of the operator although the operator has exercised proper skill and care. Explanation of the phenomena does not always eradicate the patient's opinion. Therefore, a suitable method of treatment terminating in painless, rapid and nonexpensive results will prevent many embarrassing situations which the dental surgeon might encounter concerning prolonged postoperative treatment.

Penicillin ointment, when used according to the method which will be explained, seems to fill the requirements for an efficient, rapid and comfortable recovery with little expense to the patient, and a minimum of time lost to the surgeon. One might even say that the use of penicillin ointment, as described, will leave the patient feeling that his subsequent visit is merely a part of routine postoperative care.

Clinically, after having used the ointment in postoperative infections of the alveoli in 25 consecutive cases, I find that patients have shown rather prompt relief from pain, rapid healing with healthy granulation and quick recovery with no apparent discomfort. The number of treatments per patient ranged from one to three, depending upon the severity of the infection, the general resistance of the patient, his cooperation, the condition of his mouth and other common variable factors which influence recovery from infection. No patient required more than three treatments, most requiring only two to eradicate the infection and permit healing. The greatest concern of the patient was with pain, which disappeared after the first treatment. Examination at the second visit revealed cessation of pus formation and the beginning of the healing process in almost every instance.

Penicillin ointment is the calcium salt variety in a base composed of wool fat, petrolatum, wax and cottonseed or peanut oil, or any mixture of two or more of these ingredients. The most suitable is a base of petrolatum U.S.P. It is believed that bases

containing sterol may inhibit activity of penicillin. Petrolatum U.S.P. is completely anhydrous and nonhydrophilous. The calcium salt of penicillin (amorphous) is selected for its suitability for topical use. Its particles are especially small in size, permitting more even dispersion throughout the nonhydrophilous base, which favors a release of the penicillin more slowly and more evenly in the area to which it is applied. The ointment, applied locally over a superficially infected area such as an alveolus, offers a medium for the even dispersion of penicillin in a high concentration. The penicillin is held at the site of application and is liberated slowly so that its absorption does not occur too rapidly. The potency of the penicillin is retained by the use of an anhydrous base, and the commercial preparation of the ointment is relatively stable for long periods of time. It contains 1,000 units of amorphous calcium salt of penicillin in 1 gm. of anhydrous petrolatum. It is supplied in tubes containing from 4 gm. (⅛ oz.) to 30 gm. (1 oz.). If greater potency is desired, calcium penicillin may be added to the ointment in the office. The calcium penicillin content of the ointment may be raised from 1,000 units per gram to 11,000 units per gram as desired, depending on the severity of the infection and the patient's response to treatment. I find that 1,000 units of penicillin per gram of ointment is almost always sufficient for the treatment of infected alveoli resulting from extraction of teeth. Elevation of the number of units of penicillin beyond 1,000 units per gram of ointment is in order only when the infection is so severe that response to treatment with 1,000 units is unsatisfactory. As yet, I have not found this increase of penicillin necessary. The preparation should be stored at a temperature below 15 C. (59 F.).

Because the base used is anhydrous and liquid repellent as well as nonhydrophilous, saliva or blood will not wash out the penicillin, nor will the ointment be detached easily from the alveolus if placed properly. A single application of the penicillin ointment retains the drug in high concentration over a long period of time so that its antibacterial activity occurs directly while in contact within the alveolus. The ointment seems to plug the alveolus safely and effectively, thus keeping the region free from further contaminants.

Postoperative infection of the alveolus is usually of the mixed type. Organisms most commonly found are streptococci, staphylococci, Borrelia vincenti and diplococci. Treatment with penicillin seems to be highly effective in reducing the numbers of these micro-organisms.

I use the following method of treatment:

1. The infected alveolus is isolated and the area is dried.
2. The infected clot and any necrotic tissues are removed with care to avoid furthur injury.
3. The alveolus is irrigated with a mild antiseptic solution such as 1:2,000 aqueous solution of metaphen or a similar nonirritating antiseptic solution.
4. The alveolus and the area are dried again. Sufficient penicillin ointment containing 1,000 units per gram is applied gently and packed directly into the debrided alveolus with a moistened sterile applicator. Approximately 1 gm. of ointment is usually required to pack the alveolus fully, leaving 1,000 units of calcium salt of penicillin within the alveolus to combat the infection.
5. The patient should be advised regarding home care of the mouth; hot saline solution mouth baths every two hours, if possible, should be taken carefully in order to prevent forceful dislodgement of the ointment. Energetic rinsing should be avoided. Instead, the patient should hold the hypertonic hot saline solution in the

mouth over the region involved until the solution cools, after which time the mouth should be emptied and the procedure repeated until a glassful of the hot saline solution has been used. Sedatives may be prescribed.

6. The patient is advised to return in twenty-four hours. The alveolus is examined and, if the case is obstinate, application of penicillin ointment and the home care procedure are repeated.

7. The alveolus is re-examined on the next day at which time all symptoms should have disappeared, leaving the alveolus with the beginning of healthy granulation lining of the bottom and walls of the socket. As a rule, reduction of the severity of symptoms, complete freedom from infection and the beginning of the healing process will have occurred within twenty-four hours.

I find this method of treatment with penicillin ointment to be the most efficacious at present as compared with other methods of treatment for mixed infection of the alveolus. Further results will be reported.—*60 Park Avenue.*

Round Shadows in the Maxillary Sinuses. R. W. Wright, in *Laryngoscope* 56:455, 1946.

A great many interesting problems arise as to the nature and clinical significance of cystic or polyplike structures in the maxillary sinuses. Among these are the questions of their symptomatology, the possibility of their acting as a focus of infection, and the mechanism of their production. These are the questions which the rhinologist would like answered when he examines an x-ray picture showing one or more round shadows in the maxillary sinuses.

Cysts are classified as follows:

1. Benign cysts arising from the jaw or teeth: (a) follicular or dentigerous cysts, (b) radicular or dental cysts and (c) median anterior maxillary cysts.

2. Benign cysts arising from the sinus mucosa: (a) secreting cysts including gland cysts and mucocele, and (b) nonsecreting cysts of the sinus mucosa.

The symptomatology of antral cysts is divided into several groups for clarity and convenience: (1) symptoms arising directly from the cyst, (2) those arising indirectly from the cyst, and (3) cysts producing no symptoms. In the first group there were 9 cases in which the patients had pain and soreness in the face, pain in the teeth, and (in one) numbness of the upper lip. All of the patients were relieved by puncture of the cyst.

Joint pains, vague pains and headache, fatigue, low grade fever and dizziness are other conditions suggesting a focus of infection.

The treatment of cysts of the antrum in civilian life depends on the symptoms presented. In aviation practice the presence of a cyst is considered evidence of sinus disease and its removal is a necessity for qualification, which accounts for the high percentage of surgical procedures.

In the author's cases, many of the asymptomatic cysts were discovered on routine x-ray examination of the sinuses.

Seventy-eight cases are presented. Forty-two of the patients were operated on by means of the Caldwell-Luc technic, and in all but a few of the cases opening was made in the nose. The pathologic structure most frequently found was the nonsecreting or mesothelial cyst, and in 38 patients the cysts were of this type.

In a summation, the author states that round shadows seen in x-rays may represent a cyst or polyp, and positive x-ray findings do not represent a definite pathologic entity.—J. F. Delph, in International Abstracts of Surgery, *Surg., Gynec. & Obst.* 84:225 (March) 1947.

REMOVAL OF MASSIVE SCAR TISSUE GROWTH AND BENIGN POLYP CAUSED BY ILL-FITTING LOWER DENTURE

Henry B. Clark, Jr., M.D., D.D.S.,
St. Paul

History.—A white woman, aged 58, with full upper and lower dentures, presented herself complaining that the lower denture did not fit properly, and that there was a little pea-like object which rolled around in her mouth on a slender attachment.

Examination.—Examination showed a large, firm, shapeless mass of fibrous tissue in the lower part of the mouth, lying in linear folds and extending from the left cuspid region to the right third molar region. It measured roughly 8.0 by 3.5 cm. In approximately the right cuspid region, attached to the epithelial surface of the mass, was a smooth oval polyp .9 cm. in diameter, connected by a very slender pedicle. The mass was not tender, red nor edematous. Palpation revealed no hardness suggestive of malignancy, and there was no ulceration. The mandible was grossly resorbed throughout, and it was evident that even after excision of the mass there would be very little ridge on which to construct a new denture. It was felt, however, that if a firm, stable base could be provided and every available bit of immobile area were used to seat the new denture, stability could be achieved.

Operation.—The operation was performed under nerve block with 2 per cent procaine and infiltration anesthesia and is illustrated in Figures 1 to 5. Since the growth to be excised lay entirely buccal to the crest of the ridge, an incision was made from the right third molar to the left cuspid region, just buccal to the crest. Another incision, slightly curved, was made at the outer border of the mass so that the tissue to be excised was outlined with an elliptical incision. The anterior end was then grasped with mouse-toothed forceps and drawn upward so that the lower surface could be dissected with scissors and scalpel. For the most part, the dissection was done by plunging the closed scissors into the mass, then spreading them and cautiously severing each band after careful inspection to ensure that the mental nerve was not included. In this manner, the mental nerve was ultimately found, cleaned, tagged with a No. 1 silk suture and carefully preserved without injury. Figure 3, right, shows this structure

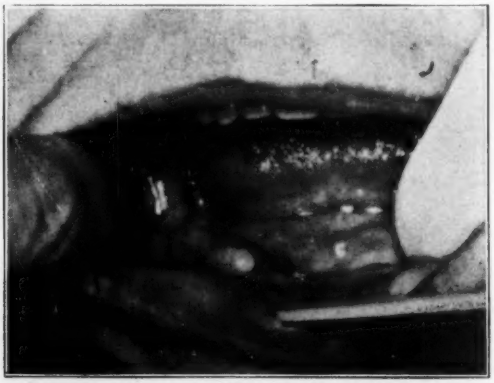

Fig. 1.—Preoperative appearance of the patient's mouth

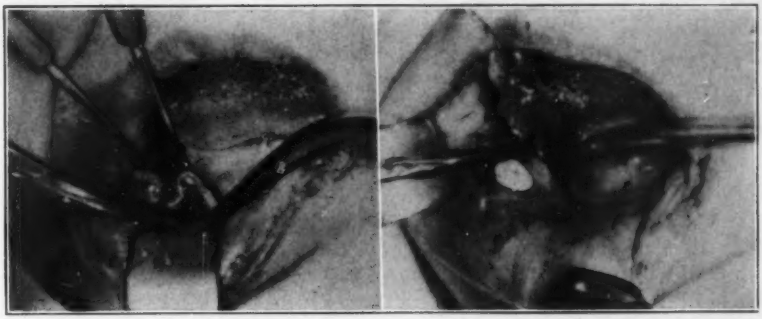

Fig. 2.—Left: Beginning of removal of the mass by means of scissors dissection. Right: One large section of the mass is nearly detached

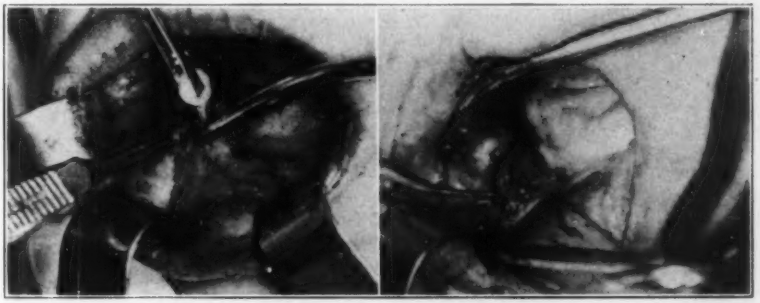

Fig. 3.—Left: Excision of the polyp which was attached to the main mass. Right: Point of foil carrier demonstrating the mental nerve, which was isolated and protected

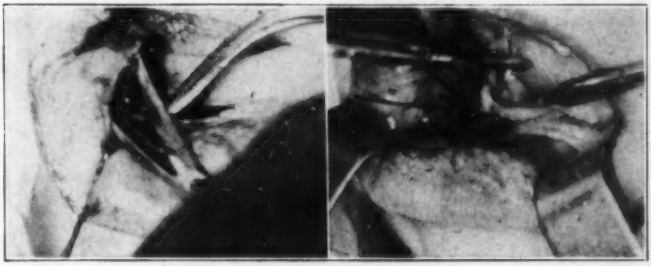

Fig. 4.—Left: Undercutting the cheek flap for relaxation prior to closure. Right: Commencement of closure with mattress sutures

being demonstrated. At length, sufficient bulk of the large mass was removed so that nothing but fascia or muscle remained on the floor of the mouth, and the outer epithelial border was drawn toward the ridge to see whether closure could be achieved without tension. It fell short by about 1 cm. The cheek epithelium was then widely undercut with scissors (Fig. 4, left), until it was seen that closure could be performed readily. The denuded area was covered by approximating the new margins with interrupted mattress sutures of C Deknatel silk. The

Fig. 5.—Left: Suturing completed. Right: Postoperative appearance six weeks after operation

result, six weeks later, is illustrated in Figure 5, right.

Course.—A St. Paul study club then accepted the patient for the construction of new full upper and lower dentures by the Fournet-Tuller technic. The patient wore the new dentures with excellent success, even exhibiting suction retention on the lower as well as the upper denture. She commented on slight sensations of burning and numbness in the region of the right side of the lower lip which gradually lessened as the weeks passed. It was felt that this quite probably was caused by the trauma to the mental nerve incident to separating it from its investing mass of scar tissue. The patient was advised that this sensation should improve as healing and repair become more complete.

Pathologist's Report.—"Benign polyp. Chronic inflammatory tissue with heavy fibrosis. No evidence of malignancy."—*1132 Lowry Medical Arts Building.*

Unilateral Hyperplasia of the Mandibular Condyle. M. A. Rushton, in *Proc. Roy. Soc. Med.* 39:431, 1946.

Hyperplasia of the mandibular condyle was first described in 1936, and up until 1926 about 17 cases had been reported. Several have since been added, and this report includes 3. The condition makes itself apparent sometime between the ages of 10 and 30. Growth of the mandible occurs from the condyle, the articular surface of which is covered by fibrous tissue with precartilaginous tissue and cartilage, and, beneath this, bone in the process of ossification is found. The formation of cartilage and its replacement by bone normally stops at about the age of 20.

The author reviews the various cases already recorded and presents the opinion that the condition is due in most instances to an abnormal continuance of growth at the condylar surface, which leads to the formation of an elongated narrow neck so long as the natural process of remodelling of the neck persists. The coronoid process does not become enlarged. The chin projects forward and to the opposite side, which causes malocclusion of the teeth. The etiology is not known.

The most successful treatment has long been known to be excision of the condyle. This could be carried out as soon as the progressive nature of the deformity is definite, but condylectomy at a very early stage might make the operative side of the jaw permanently too short.—John R. Lindsay, in International Abstracts of Surgery, *Surg., Gynec. & Obst.* 83:542 (December) 1946.

ATYPICAL ADAMANTINOMA OF THE MAXILLA: REPORT OF CASE

G. R. Maitland, D.D.S.,
Detroit

The patient, a white married woman, aged 38, was referred to me on April 20, 1939 for extraction of two upper right molars. She complained of recurrent bleeding and swelling of the gingiva in the upper right side of her mouth.

History.—The patient had the usual childhood diseases and at the age of 10 she had a severe case of typhoid fever. When 16 years old she had a hemorrhage of the right side of the nose and six years later she suffered a more severe hemorrhage from the same site. At the age of 30 she had the third and most severe hemorrhage and was hospitalized for five weeks. In 1937 she began to have violent headaches which became more frequent.

Examination.—Findings during general physical examination were negative except for bleeding and swelling of the gingival tissue in the region of the upper right second and third molars. The patient stated that there had been no marked loss of weight. Her weight at that time was 125 pounds. Reaction to the Wassermann test was negative, and the blood count was normal. Dental roentgenograms revealed loss of bony structure around the roots of the upper right second and third molars. The lower border of the right antrum appeared lower than

Fig. 1.—Microscopic section resembling mixed cell tumor of salivary gland

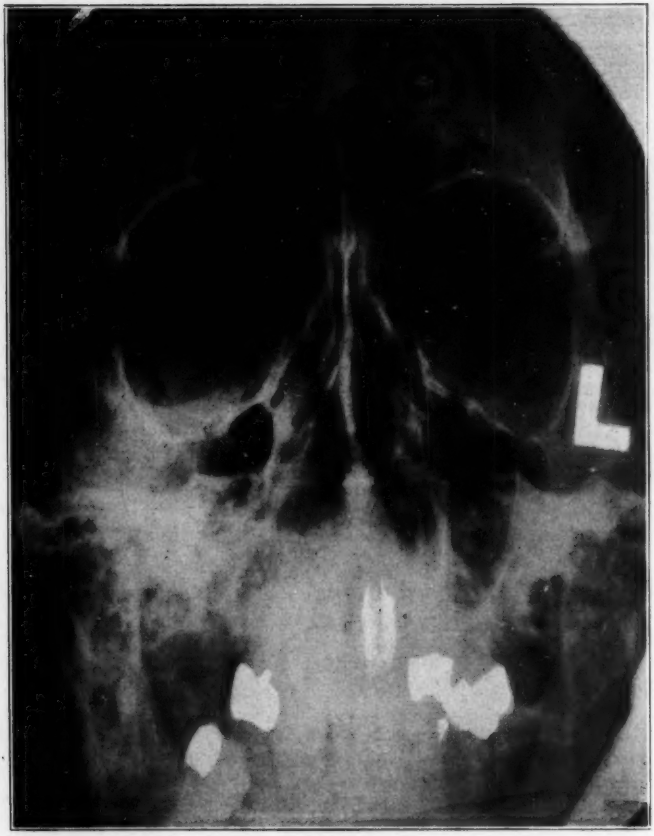

Fig. 2.—Roentgenogram taken in January 1943, showing cloudy right antrum, especially lateral half, with some rarefaction of bony structures

that of the left antrum. There was very little bony structure between the right antrum and the alveolar crest of the ridge.

Preoperative Diagnosis.—Cyst of the right side of the maxilla involving the right maxillary sinus.

Operation.—On April 21, 1939, with the patient under nitrous oxide and oxygen anesthesia, the upper right second and third molars were extracted. Exploration of the region revealed cystic invasion of the antrum, and there was a slight discharge of amber colored fluid from the sockets. No further surgical intervention was attempted at this time, and the region was packed with iodoform gauze. The clinical findings at operation did not substantiate entirely the tentative diagnosis of cyst of the antrum. The patient was referred to a roentgenologist for further examination of the sinuses and upper jaw.

Roentgen Report.—There was evidence of recent extraction of the last two molar teeth and a definite cystic area quite irregular in shape, particularly at the apex of the socket of the second molar tooth. The process appeared to extend into the floor of the antrum. Studies of the paranasal sinuses showed a definite cloudiness of the right antrum, but it was not possible

Fig. 3.—Roentgenogram taken in February 1944, demonstrating complete sclerosis of right antrum with reorganization of bone

to delineate the floor clearly. The remaining sinuses appeared quite clear. There was an area of rarefaction about the root of the upper left central incisor tooth.

Roentgenographic Diagnosis.—Cystic area at the site of recent extraction of upper second and third molar teeth and cloudiness of the right antrum.

Operation.—On April 29, 1939, with the patient under local anesthesia of 2 per cent procaine hydrochloride, an incision was made by sharp dissection through the mucoperiosteum of the right maxillary ridge. This incision extended from the first bicuspid posteriorly to the posterior aspect of the tuberosity. A lateral incision was made on the buccal wall, extending from the cuspid above to a distance of about 2 cm. By blunt dissection the mucoperiosteum was reflected on both the buccal and palatal aspects of the maxillary ridge. The remaining alveolar process was thin and honeycombed, and the color of the bone appeared to be abnormal. The greater portion of the bony floor of the antrum had been destroyed, and a large firm lobulated mass was found within the antrum, filling it completely. This mass was removed completely and sent to the laboratory for further study. The freshened edges of the wound were approximated with interrupted black silk sutures and the region was packed with iodoform gauze.

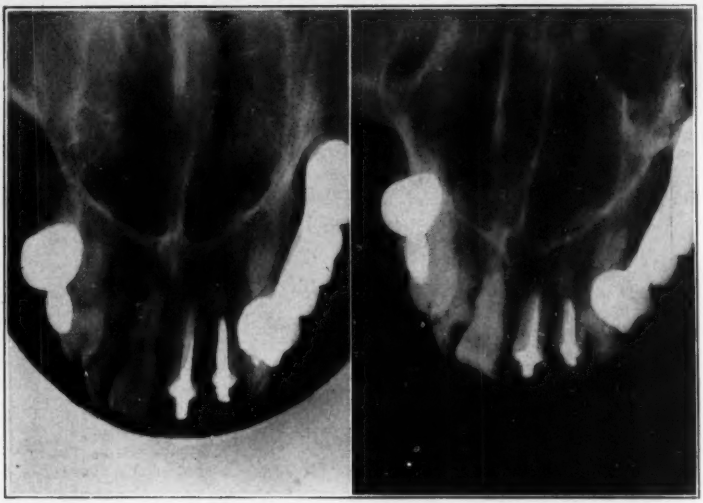

Fig. 4.—Left: Opacity of lateral half of right antrum with bone rarefaction (January 1943). Right: Complete filling in of cavity (February 1944)

Postoperative Treatment.—The gauze pack was removed on April 30, and the wound was irrigated with normal saline solution. There was no bleeding. On May 2, when all sutures were removed, the wound was closing well and healing by first intention. On May 5 the patient appeared to be comfortable. There was no bleeding or exudate, and the wound was healing well. On May 15 the soft tissue was healed and the wound was completely closed. The patient was to return for periodic monthly examination.

Pathologist's Report.—The tumor varied greatly in structure. Some areas were comprised of densely hyalinized connective tissue surrounding solid nests of polyhedral cells or gland-like spaces lined by a single layer of similar cells. In other areas there were broad sheets of large cells with large vesicular nuclei showing occasional mitotic figures, irregular gland-like spaces lined by multiple layers of similar cells and papillary infoldings. In adjacent areas the cells were distended markedly with mucus and in some areas the excessive secretion created widespread acellular areas. Although these tumors are usually only locally aggressive, the marked epithelial hyperplasia seen in this particular one made the pathologist feel that a guarded prognosis should be offered.

Pathologic Diagnosis.—Mixed cell tumor of a salivary gland (Fig. 1).

Course.—The patient was seen every month until February 1942, and there was no further swelling of the palate. She was free of headaches and had gained ten pounds. In December 1942 the patient returned. There was a marked swelling and moderate pain involving the upper right posterior maxillary ridge. The patient stated that she had gained ten pounds and felt very well except for the lesion in her mouth.

Operation.—On December 11, 1942, the patient was given an injection of procaine hydrochloride. The swollen maxillary region was incised and drained, and a purulent discharge was obtained. The wound was packed with iodoform gauze.

The patient was advised that consultation was necessary and was examined by another oral surgeon and an otolaryngologist. The latter advised another biopsy and further roentgen studies (Fig. 2). On December 13, with the patient under local anesthesia, a biopsy specimen was taken from the palatal and buccal aspects of the right maxillary mucoperiosteum.

Pathologist's Report.—A second pathologist reported hypertrophy and mild chronic inflammation. However, considering the patient's history, the pathologist requested to see the first

slide made. On his examination of this first slide, made in 1939, he diagnosed the disease as chordoma with the characteristic structures present, including large vacuolated hyperchromatic cells, sometimes called physaliphore cells, distended with mucus. The cells were packed together closely without any intercellular substance present except for areas of mucinous and myxomatous tissue separating the cellular masses so that they vaguely resembled a mixed salivary tumor. In other areas the tumor presented a distinct alveolar structure. It is occasionally mis-diagnosed as an adenocarcinoma.

Treatment.—Roentgen treatment was started immediately. The patient has been seen every month, and examination of the oral cavity is negative at this time (Figs. 3 and 4).

Summary.—The preoperative diagnosis was "cystic area involving the right antrum." The postoperative diagnosis was the same, but the area involved was more extensive than was first anticipated. The conflicting pathologic reports were: (1) mixed cell tumor of a salivary gland; (2) hypertrophy and mild chronic inflammation; (3) chordoma (which is usually a tumor of low grade malignancy, rare, slowly infiltrative and destructive, tending to recur after removal, arising from the fetal notochord, and a derivative of the endoderm), and (4) atypical adamantinoma.

Several pathologists who saw the slides called the growth an atypical adamantinoma. This diagnosis was confirmed by another physician at the hospital.

The patient began roentgen treatment during the latter part of December 1942, and it was in February 1944 that the diagnosis was changed to atypical adamantinoma. When examined in October 1946 the patient stated that she felt well and was doing all of her regular household duties. She was last seen on March 12, 1947. Her jaw appeared to be in excellent condition. She has been instructed to return to me every six months for periodic examination.—*1041 David Whitney Building.*

Some Observations on Wound Healing. J. M. Farris, and T. B. Jones, in *Surg., Gynec. & Obst.* **84**:203 (February) 1947.

1. The 725 secondary wound closures of so-called contaminated wounds resulted in satisfactory healing.

2. The results in secondary closures are not appreciably altered by either sulfonamides or penicillin when applied locally at the time of closure.

3. One of the most important factors which has allowed surgeons to close compound fractures and large soft tissue defects, often times many days after the original wound, is the security afforded by the knowledge that one possesses an agent (systemic penicillin and sulfonamides) which successfully combats hemolytic infection and prevents septicemia.

4. Secondary closure of granulating wounds can only be successfully performed when secondary débridement is carried out.

The capacity for regeneration and repair as related to wound healing involves certain fundamental principles. To speak of the wounds of warfare categorically and to consider them apart from the traumatic and surgical wounds of civilian life may lead to certain omissions in the consideration of the general features of wound healing. Present experiences indicate more than ever the importance of a sound knowledge of the basic fundamentals of surgical principles. Careful débridement skillfully carried out is still the one most important single treatment for wounds. Without it, no supplementary form of treatment will succeed. Although conditions may be far from ideal the principles of peacetime surgery continue to be perfectly valid in times of war.

Massive Iliac Bone Grafts in the Treatment of Ununited Fractures and Large Defects of Long Bones; The Combined Bone Graft—Metallic Plate Technic; An Analysis of 91 Operations on 85 Patients. Thomas Horwitz, and R. G. Lambert, in *Surg., Gynec. & Obst.* 84:435 (April) 1947.

1. The principal forte for the use of iliac bone has been the fact that it is cancellous and therefore accessible to rapid revascularization and that it is richly osteogenic. There is reason to believe that some of the iliac bone survives, in contrast to a cortical graft, and the remainder becomes rapidly invaded by new bone. Iliac bone grafts maintain a density on roentgenograms which is comparable to that of the host bone and the relationship does not change with time.

A point to be considered in the use of iliac bone is whether the cancellous ilium undergoes metaplasia to assume an architecture capable of sustaining the stresses and strains of weight bearing and muscle pull and what time element is involved. Roentgenograms appear to show evidence of such metaplasia beginning at about 12 weeks after implantation, and roentgenograms at 6 months and later show the grafts to be practically indistinguishable from the adjacent cortical bone.

Resorption of iliac grafts has occurred as late as 4 or 5 months postoperatively, due possibly to incomplete metaplasia and structural weakness of the graft and the result of stress and strain on an inadequately protected graft. This also occurs with cortical grafts and is one of the dominant reasons for the use of internal metallic fixation in conjunction with grafting procedures.

2. There are certain instances where cortical bone must be employed, for example, where grafts must be excessively long and in cases in which an absolutely straight, rigid segment of bone is required.

3. To assure absolutely rigid protection during the phase of graft incorporation, especially where large defects are being bridged, it is recommended that the plate-graft technic be employed in the surgery of nonunion and massive defects of single long bones, as the femur and humerus, and in the presence of nonunion of both bones of the forearm and leg. Where one of the bones of the forearm is intact, and in the leg in the presence of an intact fibula, the graft alone, held with two or more screws above and below the level of the fracture, offers adequate fixation.

4. The technic of plate-graft application and of fixation of the graft when used alone without a plate must be varied to meet the mechanical requirements in each case. Incisions may have to be varied depending on the degree and site of soft tissue scarring. The oblique type of fracture lends itself very well to simple transfixion with the use of multiple screws.

5. Failure of the bone graft operation with recurrence of nonunion, excluding those cases associated with postoperative infection, has been due to such errors in technic as failure to use a plate when specifically indicated and failure to use a plate of adequate length.

6. Postoperative infection does not mean failure of iliac graft incorporation, especially if the infection is mild and well controlled and removal of the metallic fixation can be deferred.

In an effort to account for this complication, the authors place much significance on the fact that in a certain number of battle fractures active growths of bacteria have been cultured from the site of original wounding six months to one year following the cessation of all drainage. Since there is no way, at this time, to determine accurately the presence of living bacteria at the site of injury prior to or at the time of surgery or to eliminate this factor effectively, the authors have concluded that there will continue to be an irreducible minimum incidence of postoperative infection following bone graft or other reconstructive bone surgery of battle fractures.

INDEX TO JOURNAL OF ORAL SURGERY

1947

A

ABBOTT, DAVID; GLENN, J. M. and FARRINGTON, JOSEPH. Stomatitis after administration of penicillin. 149

ABBOTT, et al. Penicillin therapy and free bone grafts. 129 Abstract

ABERRANT TEETH; See Extraction—impacted teeth

ABSCESS
brain: See Brain abscess

ABSORPTION OF BONE: See Bone-resorption

ACKERMAN, L. V. and MEATHERINGHAM, R. E. Aspiration biopsy of lymph nodes. 237 Abstract

ACRYLIC RESIN
Blaine, G. Uses of plastics in surgery. 266 Abstract

ADAMANTINOMA
Maitland, G. R. Atypical adamantinoma of the maxilla: report of case. 351
Peterson, R. G. Adamantinoma (ameloblastoma) of the mandible. 78

ALLERGY
sulfa drugs: See Sulfanilamide and related compounds—reactions to

ALTEMIER, W. A. and WADSWORTH, C. L. Penicillin: its use in surgery and influence on earlier types of chemotherapy. 229 Abstract

ALVEOLECTOMY
Svoboda, J. F. Clinical study of repair of bone after alveolectomy. 91

AMELOBLASTOMA: See Adamantinoma

AMERICAN BOARD OF ORAL SURGERY
American Board of Oral Surgery. 16, 105, 207

AMERICAN RED CROSS: See National Blood Program

AMERICAN SOCIETY FOR ADVANCEMENT OF GENERAL ANESTHESIA IN DENTISTRY
Profession invited to attend spring meeting. 9

AMERICAN SOCIETY OF ORAL SURGEONS
American Society of Oral Surgeons. 107

AMINO ACIDS
Madden, et al. Amino acids in therapy of disease. 179 Abstract

ANATOMY
maxillary sinus: See Maxillary sinus and antrum

ANESTHESIA
Arrowood, Julia G. Management of anesthesia for oral surgical operations on the hospitalized patient. 305
exhalation deflector—Rose, R. P. and Black, E. E. Exhalation deflector. 312

ANESTHESIA AND ANESTHETICS
Williams, P. E. Fear, pain and anesthesia. 141

ANESTHESIA AND ANESTHETICS, general
nitrous oxide Seldin, H. M. Nitrous oxide and potent synergists in oral surgery. 131
pentothal sodium Kessler, H. E. Pentothal sodium anesthesia by way of the sternum. 106
Krogh, H. W. Use of thiopental sodium in dental surgery. 337
Seldin, H. M. Nitrous oxide and potent synergists in oral surgery. 131

ANGINA
Ludwig's: See Ludwig's angina

ANKYLOSIS
Goodsell, J. O. Tantalum in temporomandibular anthroplasty: report of case. 41
Northrop, P. M. Temporomandibular ankylosis: report of case. 256

ANTHRAX: See Systemic conditions manifested in the mouth—anthrax

ANTIBIOTICS: See Penicillin; Sulfanilamide and related compounds

ARMER, A. L. Removal of impacted third molar from antrum: report of case. 243

ARROWOOD, JULIA G. Management of anesthesia for oral surgical operations on the hospitalized patient. 305

ARTHROPLASTY: See Mandible and maxilla—resection

ASSOCIATIONS AND SOCIETIES: See names of specific organizations

B

BARCLAY, L. T., et al. Management of jaw fractures. 237 Abstract

BELLINGER, D. H. Preliminary report on the use of tantalum in maxillofacial and oral surgery. 108

BENIGN TUMORS: See Tumors

BERGER, ADOLPH. Solitary central giant-cell tumor of the jaw bones. 154

BILLMAN, HOWARD and DINGMAN, R. O. Double lip. 146

BIOPSY
Meatheringham, R. E. and Ackerman, L. V. Aspiration biopsy of lymph nodes. 237 Abstract

BLACK, E. E. and ROSE, R. P. Exhalation deflector. 312

BLAINE, G. Uses of plastics in surgery. 266 Abstract

BLOCKER, R. G., Jr. Cancellous bone grafts to the Jaw. 336 Abstract

BLOOD
coagulation: See Hemorrhage—control
plasma Snyder, H. E. Blood plasma. 226 Abstract

BONE
cancellous: See Bone—grafting; Face—reconstruction
Blocker, R. G., Jr., Cancellous bone grafts to the Jaw. 336 Abstract
grafting Abbott, et al. Penicillin therapy and free bone grafts. 129 Abstract
diseases: See Osteomyelitis
Horwitz, Thomas and Lambert, R. G. Massive iliac bone grafts in the treatment of ununited fractures and large defects of long bones: the combined bone graft-metallic plate technic: an analysis of 91 operations on 85 patients. 356 Abstract
Macomber, D. W. Reconstruction of bony defects of the face with special reference to cancellous iliac bone. 304 Abstract
Parker, D. B. Fracture of the mandible with non-union and bone graft. 171
regeneration Lattes, R. and Frantz, V. K. Absorbable gauze in bone surgery. 263 Abstract
Svoboda, J. F. Clinical study of repair of bone after alveolectomy. 91
resorption Electrolytic absorption of bone. 178 Abstract

BOOK REVIEWS
Mead, S. V. Oral surgery. 267
Miller, S. C. Oral diagnosis and treatment: a textbook for students and practitioners of dentistry and medicine. 268
Tylman, S. D. and Peyton, F. A. Acrylics and dental resins. 269

BOOTH, R. M. Treatment of mandibular fractures by external fixation. 245
BOYKO, G. V. Classification of extensive cysts of the jaws. 325
and MOHNAC, A. M. Extensive dentigerous cyst of the maxilla with intracystic ameloblastic papilloma. 217
BRAIN ABSCESS
Miller, C. R. Cellulitis of the face complicated by brain abscess: report of case. 21
BRIGGS, O. C. Anthrax of the oral cavity. 173
BROWN, J. B., et al. Facial asymmetry and malocclusion from hyperplasia of the mandible. 263 Abstract

C

CALCULUS
salivary Repass, F. G. Salivary calculus in Wharton's duct: report of case. 75
CAMERON, J. R. and STETZER, J. J., Jr. Metastatic carcinoma of mandible: report of case. 227
CANCER
See also Tumors
metastasis Cameron, J. R. and Stetzer, J. J., Jr. Metastatic carcinoma of mandible: report of case. 227
CARCINOMA: See Cancer; See also Tumors
CELLULITIS
Miller, C. R. Cellulitis of the face complicated by brain abscess: report of case. 21
CHEMOTHERAPY
See also Penicillin; Sulfanilamide and related compounds
Local chemotherapy of wounds. 32 Reprint.
CLARK, H. B., Jr. Removal of massive scar tissue growth and benign polyp caused by ill-fitting lower denture. 348
CLEFT PALATE AND HARELIP
Test, A. R. and Falls, H. F. Dominant inheritance of cleft lip and palate in five generations. 292
prosthetic treatment Kazanjian, V. H. Prosthetic restoration of congenital and acquired deformities of hard and soft palate. 181
surgical treatment Harris, H. I. Packing the lateral incisions in cleft palate repair. 215
CONDYLE: See Fractures—jaws; Temporomandibular joint—diseases
CONLEY, J. J. and STEWART, M. B. Fractures of the malar-zygomatic compound: treatment by improved methods and myoplasty. 265 Abstract
COOK, T. J. Responsibility of the oral surgeon in recognition of systemic disease by oral symptoms. 319
CYSTS
See also Odontoma
Boyko, G. V. Classification of extensive cysts of the jaws. 325
and Mohnac, A. M. Extensive dentigerous cyst of the maxilla with intracystic ameloblastic papilloma. 217
Dittmer, C. K. Dentigerous cyst of the mandible: report of case. 81
Thomas, E. H. Cysts of the jaws: saving involved vital teeth by tube drainage. 1
Wright, R. W. Round shadows in the maxillary sinuses. 347 Abstract

D

DENTURES
lesions caused by Clark, H. B., Jr. Removal of massive scar tissue growth and benign polyp caused by ill-fitting lower denture. 348
DIAGNOSIS, dental
See also Biopsy
Dingman, R. O. and Hayward, J. R. Value of writing case histories. 123
DINGMAN, R. O. and BILLMAN, HOWARD. Double lip. 146
and HAYWARD, J. R. Value of writing case histories. 123
DISLOCATION OF MANDIBLE
Schultz, L. W. Report of ten years' experience in treating hypermobility of the temporomandibular joints. 202
DITTMER, C. K. Dentigerous cyst of the mandible: report of case. 81

E

ENGLAND, L. C.; KUTCH, J. H.; MALLETT, S. P. and GOLAN, H. P. Acute myelogenous leukemia with primary oral manifestations. 209
EWING, J. W. Technics in the control of operative and postoperative hemorrhage. 315
EXHALATION DEFLECTOR: See Anesthesia—exhalation deflector
EXODONTIA: See Extraction
EXTRACTION
impacted teeth Armer, A. L. Removal of impacted third molar from antrum: report of case. 243
McKenzie, Charles and Sharpless, D. H. Surgical removal of aberrant teeth: report of two cases. 231
Wahl, J. P. Drifting or migrating teeth. 174
infection following Ewing, W. T. Immediate and fatal septicemia after tooth extraction. 230
postoperative complications and care Henny, F. A. Postoperative infection and hemorrhage after extraction of third molar. 208
Seldon, T. H. Importance of blood in preoperative and postoperative treatment. 234 Abstract
Wahl, J. P. Drifting or migrating teeth. 174
EWING, W. T. Immediate and fatal septicemia after tooth extraction. 230

F

FACE
abnormality Brown, J. B., et al. Facial asymmetry and malocclusion from hyperplasia of the mandible. 263 Abstract
deformities: See Mandible and Maxilla—resection; Orthodontic treatment
reconstruction Macomber, D. W. Reconstruction of bony defects of the face, with special reference to cancellous iliac bone. 304 Abstract
FALLS, H. F. and TEST, A. R. Dominant inheritance of cleft lip and palate in five generations. 292
FARRINGTON, JOSEPH; ABBOTT, DAVID and GLENN, J. M. Stomatitis after administration of penicillin. 149
FARRIS, J. M. and JONES, T. B. Some observations on wound healing. 355 Abstract
FEAR: See Psychology, dental: Pain—prevention and control
FIBROMA
Marré, J. M. Removal of osteofibroma: report of case. 241
Maris, A. M. Effect of roentgenotherapy on osteofibroma of the maxilla. 223
FRACTURES
jaws: See also Maxillo-facial injuries
Barclay, L. T., et al. Management of jaw fractures. 237
Booth, R. M. Treatment of mandibular fractures by external fixation. 245
Magee, H. N. Compound comminuted fracture of the mandible: report of case. 238

Horwitz, Thomas and Lambert, R. G. Massive iliac bone grafts in the treatment of ununited fractures and large defects of long bones: the combined bone graft-metallic plate technic: an analysis of 91 operations on 85 patients. 356 Abstract
Members of the Chalmers J. Lyons Club. Fractures involving the mandibular condyle: a post-treatment survey of 120 cases. 45
Parker, D. B. Bilateral condylar fractures. 168
Fracture of the mandible with nonunion and bone graft. 171
Peterson, R. G. Compound, completely displaced fracture of the mandible: report of case. 33
Rode, R. B. Complicated fracture of the mandible: report of case. 259
Waggener, D. T. Multiple fractures of the facial bones: report of case. 10
Weinberg, B. W. Penicillin in fracture wound infections. 270 Abstract
FRANTZ, V. K. and LATTES, R. Absorbable gauze in bone surgery. 263 Abstract

G

GALLIE, W. E. Ideals in surgery. 255 Abstract
GAUZE
Lattes, R. and Frantz, V. K. Absorbable gauze in bone surgery. 263 Abstract
GENERAL ANESTHETICS: See Anesthesia and anesthetics, general
GLENN, J. M.; FARRINGTON, JOSEPH and ABBOTT, DAVID. Stomatitis after administration of penicillin. 149
GOLAN, H. P.; ENGLAND, L. C.; KUTCH, J. H. and MALLETT, S. P. Acute myelogenous leukemia with primary oral manifestations. 209
GOODSELL, J. O. Tantalum in temporomandibular arthroplasty: report of case. 41

H

HAGSTROM, A. R. Penicillin in the treatment of osteomyelitis: report of case. 235
HAMILTON, P. H. Roentgenotherapy of maxillary giant-cell tumor. 261
HARRIS, H. I. Packing the lateral incisions in cleft palate repair. 215
HAYWARD, J. R. and DINGMAN, R. O. Value of writing case histories. 123
HEMOPHILIA
Lewis, R. I. and Jack, William. Problem of hemophilia in oral surgery. 37
HEMORRHAGE
See also Hemophilia
control Ewing, J. W. Technics in the control of operative and postoperative hemorrhage. 315
Seldon, T. H. Importance of blood in preoperative and postoperative treatment. 234 Abstract
Uihlein, Alfred, et al. Absorbable oxidized cellulose with thrombin as a hemostatic agent in surgical procedures. 176 Abstract
HENNY, F. A. Postoperative infection and hemorrhage after extraction of third molar. 208
HEREDITY
cleft lip and palate: See Cleft palate and harelip
HOLLAND, D. J., Jr. Preoperative and postoperative care in oral surgery. 298
HORWITZ, THOMAS, and LAMBERT, R. G. Massive iliac bone grafts in the treatment of ununited fractures and large defects of long bones: the combined bone graft-metallic plate technic: an analysis of 91 operations on 85 patients. 356 Abstract
HYPERPLASIA OF MANDIBLE: See Mandible and maxilla—diseases

I

IMPACTED TEETH: See Extraction—impacted teeth

J

JACK, WILLIAM and LEWIS, R. I. Problem of hemophilia in oral surgery. 37
JACOBS, M. H. Anatomic study of the maxillary sinus from the standpoint of the oral surgeon. 282
JONES, T. B. and FARRIS, J. M. Some observations on wound healing. 355 Abstract

K

KAZANJIAN, V. H. Prosthetic restoration of congenital and acquired deformities of hard and soft palate. 181
KEMPER, J. W. Surgical correction of mandibular prognathism: report of case. 29
KESSLER, H. E. Pentothal sodium anesthesia by way of the sternum. 106
KROGH, H. W. Use of thiopental sodium in dental surgery
KUTCH, J. H.; MALLETT, S. P.; GOLAN, H. P. and ENGLAND, L. C. Acute myelogenous leukemia with primary oral manifestations. 209

L

LAMBERT, R. G. and HORWITZ, THOMAS, Massive iliac bone grafts in the treatment of ununited fractures and large defects of long bones: the combined bone graft-metallic plate technic: an analysis of 91 operations on 85 patients. 356 Abstract
LATTES, R. and FRANTZ, V. K. Absorbable gauze in bone surgery. 263 Abstract
LEUKEMIA: See Systemic conditions manifested in mouth—leukemia
LEWIS, R. I. and JACK, WILLIAM. Problem of hemophilia in oral surgery. 37
LICENSURE
specialists: See American Board of Oral Surgery
LIP
Dingman, R. O. and Billman, Howard. Double lip. 146
cleft: See Cleft palate and harelip
LIGATION: See Hemorrhage—control
LUDWIG'S ANGINA
Miller, C. R. Ludwig's angina with overwhelming widespread sepsis: report of case. 23

M

MACOMBER, D. W. Reconstruction of bony defects of the face, with special reference to cancellous iliac bone. 304 Abstract
MADDEN, et al. Amino acids in therapy of disease. 179 Abstract
MAGEE, H. N. Compound comminuted fracture of the mandible: report of case. 238
MAITLAND, G. R. Atypical adamantinoma of the maxilla: report of case. 351
MALIGNANT TUMORS: See Tumors
MALLETT, S. P.; GOLAN, H. P.; ENGLAND, L. C. and KUTCH, J. H. Acute myelogenous leukemia with primary oral manifestations. 209
MANDIBLE AND MAXILLA
diseases Miller, C. R. Hereditary hypertrophy of the maxilla and mandible: report of case. 25

Repass, F. G. Osteomyelitis of the maxilla: report of case. 74
resection Goodsell, J. O. Tantalum in temporomandibular arthroplasty: report of case. 41
Kemper, J. W. Surgical correction of mandibular prognathism: report of case. 29
McNichol, J. W. and Roger, A. T. Original method of correction of hyperplastic asymmetry of the mandible. 264 Abstract
Miller, C. R. Hereditary hypertrophy of the maxilla and mandible: report of case. 25
MARIS, A. M. Effect of roentgenotherapy on osteofibroma of the maxilla. 223
MARRE, J. M. Removal of osteofibroma: report of case. 241
MATERIA MEDICA AND THERAPEUTICS
Lattes, R. and Frantz, V. K. Absorbable gauze in bone surgery. 263 Abstract
Madden, et al. Amino acids in therapy of disease. 179 Abstract
MAXILLARY SINUS AND ANTRUM
Armer, A. L. Removal of impacted third molar from antrum: report of case. 243
Jacobs, M. H. Anatomic study of the maxillary sinus from the standpoint of the oral surgeon. 282
Thoma, K. H. Diseases of the maxillary sinuses resulting from pathologic changes. 271
Wright, R. W. Round shadows in the maxillary sinuses. 347 Abstract
MAXILLO-FACIAL INJURIES
See also Fractures—jaws; Plastic surgery
Bellinger, D. H. Preliminary report on the use of tantalum in maxillo-facial and oral surgery. 108
Stewart, M. B. and Conley, J. J. Fractures of the malar-zygomatic compound: treatment by improved methods and myoplasty. 265 Abstract
Waggener, D. T. Multiple fractures of the facial bones: report of case. 10
McCLURE, G. Odontoma of the nasopharynx. 263 Abstract
McKENZIE, CHARLES and SHARPLESS, D. H. Surgical removal of aberrant teeth: report of two cases. 231
McNICHOL, J. W. and ROGER, A. T. Original method of correction of hyperplastic asymmetry of the mandible. 264 Abstract
MEAD, S. V. Oral Surgery. (Book rev.) 267
MEATHERINGHAM, R. E. and ACKERMAN, L. V. Aspiration biopsy of lymph nodes. 237 Abstract
MEMBERS OF THE CHALMERS J. LYONS CLUB. Fractures involving the mandibular condyle: a post-treatment survey of 120 cases. 45
METASTASIS: See Cancer—metastasis
METHYL-METHACRYLATE: See Acrylic resins
MIGRATORY TEETH: See Extraction—migratory teeth
MILLER, C. R. Cellulitis of the face complicated by brain abscess: report of case. 21
Hereditary hypertrophy of the maxilla and mandible: report of case. 25
Ludwig's angina with overwhelming widespread sepsis: report of case. 23
Sulfadiazine reactions: report of three cases. 17
MILLER, S. C. Oral diagnosis and treatment: a textbook for students and practitioners of dentistry and medicine. (Book rev.) 268
MOHNAC, A. M. and BOYKO, G. V. Extensive dentigerous cyst of the maxilla with intracystic ameloblastic papilloma. 217
MORRIS, ROBERT. Four eras in surgery. 180 Abstract
MOUTH LESIONS
Briggs, O. C. Anthrax of the oral cavity. 173

N

NATIONAL BLOOD PROGRAM
National Blood Program. 314
NITROUS OXIDE: See Anesthesia and anesthetics, general—nitrous oxide
NORTHROP, P. M. Temporomandibular ankylosis: report of case. 256

O

OBTURATORS AND SIMILAR APPLIANCES
Kazanjian, V. H. Prosthetic restoration of congenital and acquired deformities of hard and soft palate. 181
ODONTOMA
McClure, G. Odontoma of the nasopharynx. 263 Abstract
Wass, S. H. Odontomes and other affections of the jaws: their pathology, diagnosis and treatment. 264 Abstract
OPEN BITE: See Mandible and maxilla—resection
ORAL SURGERY
See also Anesthesia; Fractures—jaws; Mandible and maxilla—resection; Maxillo-facial injuries
Holland, D. J., Jr. Preoperative and postoperative care in oral surgery. 298
anesthesia: See Anesthesia; Anesthesia and anesthetics
drainage Thomas, E. H. Cysts of the jaws: saving involved vital teeth by tube drainage. 1
graft and flap operation Bellinger, D. H. Preliminary report on the use of tantalum in maxillo-facial and oral surgery. 108
ORTHODONTIC TREATMENT
Brown, J. B., et al. Facial asymmetry and malocclusion from hyperplasia of the mandible. 263 Abstract
OSLER, WILLIAM. Biographical sketch. 177
OSTEOFIBROMA: See Fibroma
OSTEOMYELITIS
Hagstrom, A. R. Penicillin in the treatment of osteomyelitis: report of case. 235
Repass, F. G. Osteomyelitis of the maxilla: report of case. 74
OSTEOTOMY: See Mandible and maxilla—resection
OXIDIZED CELLULOSE: See Hemorrhage—control

P

PAIN
prevention and control Williams, P. E. Fear, pain and anesthesia. 141
PALATE, cleft: See Cleft palate and harelip
PARKER, D. B. Bilateral condylar fractures. 168
Fracture of the mandible with nonunion and bone graft. 171
PENICILLIN
Abbott, et al. Penicillin therapy and free bone grafts. 129 Abstract
Altemier, W. A. and Wadsworth, C. L. Penicillin: its use in surgery and influence on earlier types of chemotherapy. 299 Abstract
Farrington, Joseph; Abbott, David and Glenn, J. M. Stomatitis after administration of penicillin. 149
Hagstrom, A. R. Penicillin in the treatment of osteomyelitis: report of case. 235
Weinberg, B. W. Penicillin in fracture wound infections. 270 Abstract

Zeff, Seymour. Preliminary report on penicillin ointment in postoperative mixed infection of the alveolus. 345

PENTOTHAL SODIUM: See Anesthesia and anesthetics, general—pentothal sodium

PETERSON, R. G. Adamantinoma of the (Ameloblastoma) mandible. 78

Compound, completely displaced fracture of the mandible: report of case. 33

PEYTON, F. A. and TYLMAN, S. D. Acrylics and other dental resins. (Book rev.) 269

PLASTIC SURGERY

Blaine, G. Uses of plastics in surgery. 266. Abstract

POLYP

Clark, H. B., Jr. Removal of massive scar tissue growth and benign polyp caused by ill-fitting lower denture. 348

PROGNATHISM

See Mandible and maxilla—resection

PSYCHOLOGY

dental Williams, P. E. Fear, pain and anesthesia. 141

R

RECORDS AND RECORD KEEPING

Dingman, R. O. and Hayward, J. R. Value of writing case histories. 123

REPASS, F. G. Osteomyelitis of the maxilla: report of case. 74

Salivary calculus in Wharton's duct: report of case. 75

REYNOLDS, C. R. Graduate training in surgery. 244 Abstract

RODE, R. B. Complicated fracture of the mandible: report of case. 259

ROENTGENOTHERAPY

Maris, A. M. Effect of roentgenotherapy on osteofibroma of the maxilla. 223

ROGERS, A. T. and McNICHOL, J. W. Original method of correction of hyperplastic asymmetry of the mandible. 264 Abstract

ROSE, R. P. and BLACK, E. E. Exhalation deflector. 312

RUSHTON, M. A. Unilateral hyperplasia of the mandibular condyle. 350 Abstract

S

SALIVARY CALCULUS: See Calculus—salivary

SCAR TISSUE GROWTH REMOVAL: See Polyp

SCHULTZ, L. W. Report of ten years' experience in treating hypermobility of the temporomandibular joints. 202

SELDIN, H. M. Nitrous oxide and potent synergists in oral surgery. 131

SELDON, T. H. Importance of blood in preoperative and postoperative treatment. 234 Abstract

SHARPLESS, D. H. and McKENZIE, CHARLES. Surgical removal of aberrant teeth: report of two cases. 231

SIALODUCTITIS: See Calculus—salivary

SNYDER, H. E. Blood plasma. 226 Abstract

STETZER, J. J., Jr. and CAMERON, J. R. Metastatic carcinoma of mandible: report of case. 227

STEWART, M. B. and CONLEY, J. J. Fractures of the malar-zygomatic compound: treatment by improved methods and myoplasty. 265 Abstract

STOMATITIS

Farrington, Joseph; Abbott, David and Glenn, J. M. Stomatitis after administration of penicillin. 149

SUBLUXATION OF MANDIBLE: See Dislocation of mandible

SULFANILAMIDE AND RELATED COMPOUNDS

reactions to Miller, C. R. Sulfadiazine reactions: report of three cases. 17

SURGERY

education Gallie, W. E. Ideals in surgery. 255 Abstract

Reynolds, C. R. Graduate training in surgery. 244 Abstract

history Morris, Robert. Four eras in surgery. 180 Abstract

oral: See Oral surgery: see also related listings, i.e. Anesthesia; Mandible and maxilla—resection; Maxillofacial injuries, etc.

plastic: See Plastic surgery

SVOBODA, J. F. Clinical study of repair of bone after alveolectomy. 91

SWELLINGS OF FACE AND NECK: See Cellulitis

SYSTEMIC CONDITIONS MANIFESTED IN THE MOUTH

Cook, T. J. Responsibility of the oral surgeon in recognition of systemic disease by oral symptoms. 319

anthrax Briggs, O. C. Anthrax of the oral cavity. 173

leukemia Mallett, S. P.; Golan, H. P.; England, L. C. and Kutch, J. H. Acute myelogenous leukemia with primary oral manifestations. 209

T

TANTALUM

Bellinger, D. H. Preliminary report on the use of tantalum in maxillofacial and oral surgery. 108

Goodsell, J. O. Tantalum in temporomandibular arthroplasty: report of case. 41

TEETH

migratory: See Extraction — impacted teeth

molars—third: See also Extraction—impacted teeth

Armer, A. L. Removal of impacted third molar from antrum: report of case. 243

Henny, F. A. Postoperative infection and hemorrhage after extraction of third molar. 208

TEMPOROMANDIBULAR JOINT

diseases Goodsell, J. O. Tantalum in temporomandibular anthroplasty: report of case. 41

Northrop, P. M. Temporomandibular ankylosis: report of case. 256

Rushton, M. A. Unilateral hyperplasia of the mandibular condyle. 350 Abstract

Schultz, L. W. Report of ten years' experience in treating hypermobility of the temporomandibular joints. 202

TEST, A. R. and FALLS, H. F. Dominant inheritance of cleft lip and palate in five generations. 292

THIOPENTAL SODIUM: See Anesthesia and anesthetics general—pentothal sodium

THIRD MOLARS: See Teeth — molars — third; See also Extraction—impacted teeth

THOMA, K. H. Diseases of the maxillary sinuses resulting from pathologic changes. 271

THOMAS, E. H. Cysts of the jaws: saving involved vital teeth by tube drainage. 1

THROMBIN: See Hemorrhage—control

TUMORS

Berger, Adolph. Solitary central giant-cell tumor of the jaw bones. 154

Boyko, G. V. and Mohnac, A. M. Extensive dentigerous cyst of the maxilla with intracystic ameloblastic papilloma. 217

Hamilton, P. H. Roentgenotherapy of maxillary giant-cell tumor. 261

TYLMAN, S. D. and PEYTON, F. A. Acrylics and other dental resins. (Book rev.) 269

U

UIHLEIN, ALFRED, et al. Absorbable oxidized cellulose with thrombin as a hemostatic agent in surgical procedures. 176 Abstract

V

VITAMIN C
Wolfer, J. A. et al. Experimental study in wound healing in vitamin C depleted human subjects. 269 Abstract

W

WADSWORTH, C. L. and ALTEMIER, W. A. Penicillin: its use in surgery and influence on earlier types of chemotherapy. 229 Abstract
WAGGENER, D. T. Multiple fractures of the facial bones: report of case. 10
WAHL, J. P. Drifting or migrating teeth.
WALDRON, C. W. (Reviewed by) Acrylics and other dental resins. S. D. Tylman and F. A. Peyton. 269
Oral diagnosis and treatment: a textbook for students and practitioners of dentistry and medicine. S. C. Miller. 268
Oral surgery. S. V. Mead. 267
WASS, S. H. Odontomes and other affections of the jaws: their pathology, diagnosis and treatment. 264 Abstract
WEINBERG, B. W. Penicillin in fracture wound infections. 270 Abstract
WILLIAMS, P. E. Fear, pain and anesthesia. 141
WISDOM TEETH: See Teeth—molars—third
WOLFER, J. A. et al. Experimental study in wound healing in vitamin C depleted human subjects. 269 Abstract
WOUNDS AND INJURIES
healing Farris, J. M. and Jones, T. B. Some observations on wound healing. 355 Abstract
Wolfer, J. A. et al. Experimental study in would healing in vitamin C depleted human subjects. 269 Abstract
WRIGHT, R. W. Round shadows in the maxillary sinuses. 347 Abstract

X

X-RAY
treatment: See Roentgenotherapy

Z

ZEFF, SEYMOUR. Preliminary report on penicillin ointment in postoperative mixed infection of the alveolus. 345.